# Instrumentation Issues

MWGaiaDN Tech Workshop

July 15-16th, 2025

Gaizka Murga (gzk@idom.com) - Head of Astronomy and Space

# About IDOM


Bilbao IDOM Headquarters

**IDOM ADA** develops high performance optical and mechatronic built-to-spec solutions for Science and Technology.

IDOM ADA operates from Bilbao IDOM Headquarters (Spain) and IDOM US branch in Minneapolis (MN, US), and delivers its products and services to the best research institutions in the world.

| 5300 Professionals | Since 1957 | 979 Partners | 125 Countries |
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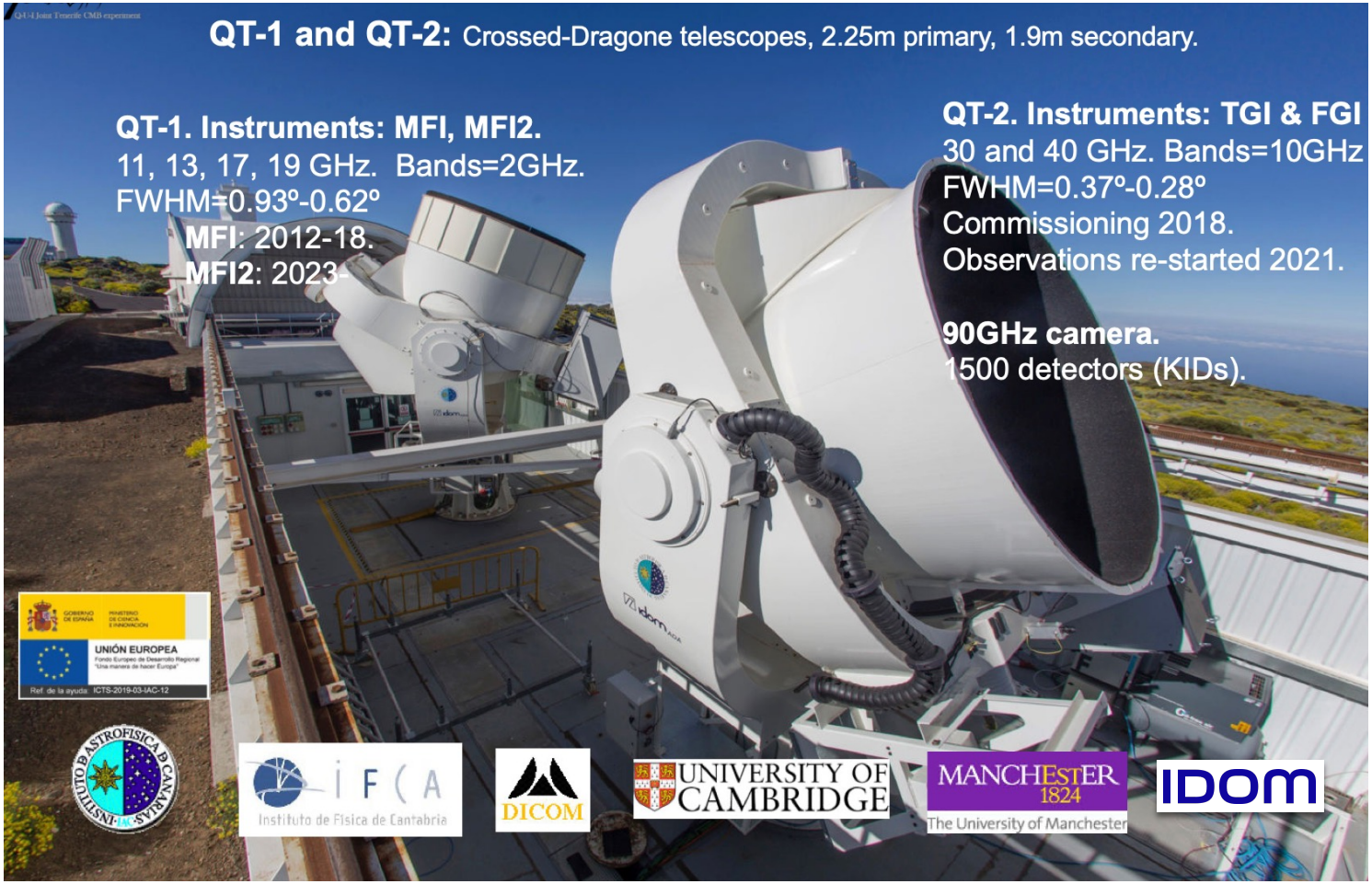
IDOM operates globally in areas such as power generation, oil & gas, renewable and alternative energies, manufacturing industry, cilivil infrastructures, nuclear plants, architecture and unique challenging engineering projects.

# About IDOM


AIT Laboratory

- Expertise in Optics / Mechanisms / Control
- Systems Engineering / Project Management
- Analysis and Simulation expertise
- Large network of qualified suppliers
- Instrument AIT Laboratory: 1000 $m^2$, 6,3 ton lifting capacity, 4m height under the hook).
- Equiped with Cleanrooms, Metrology Equipment, Optical Alignment and Test Equipment, Cryogenic Test Equipment, etc.

# QUIJOTE CMB

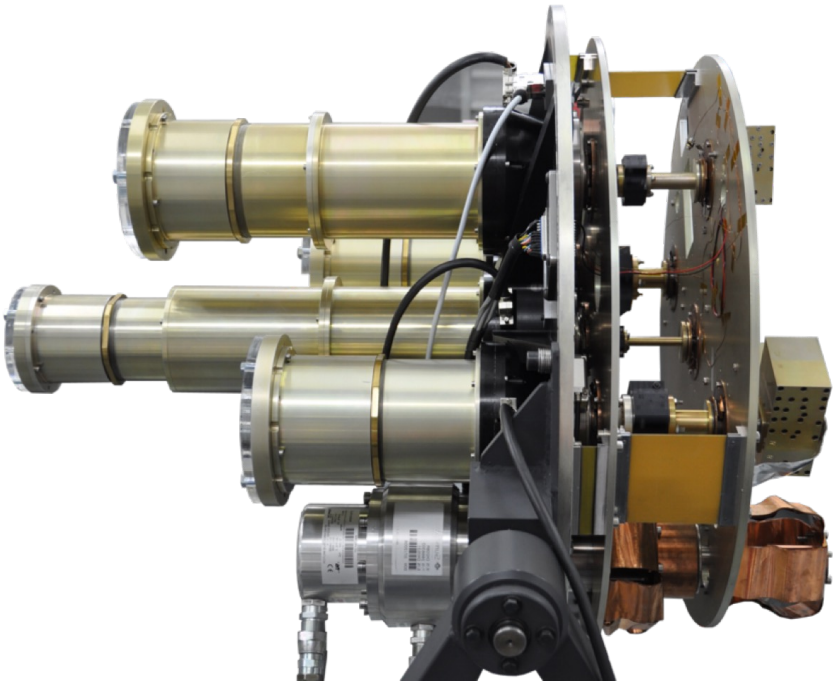

QT-1 and QT-2: Crossed-Dragone telescopes, 2.25m primary, 1.9m secondary.
QT-1. Instruments: MFI, MFI2.
11, 13, 17, 19 GHz. Bands=2GHz.
FWHM=0.93º-0.62º
MFI: 2012-18.
MFI2: 2023-
QT-2. Instruments: TGI & FGI
30 and 40 GHz. Bands=10GHz
FWHM=0.37º-0.28º
Commissioning 2018.
Observations re-started 2021.
90GHz camera.
1500 detectors (KIDs).
UNIÓN EUROPEA
Ref. de la ayuda: ICTS-2019-03-IAC-12
INSTITUTO DE ASTROFÍSICA DE CANARIAS
IFCA
Instituto de Física de Cantabria
DICOM
UNIVERSITY OF CAMBRIDGE
MANCHESTER 1824
The University of Manchester
IDOM

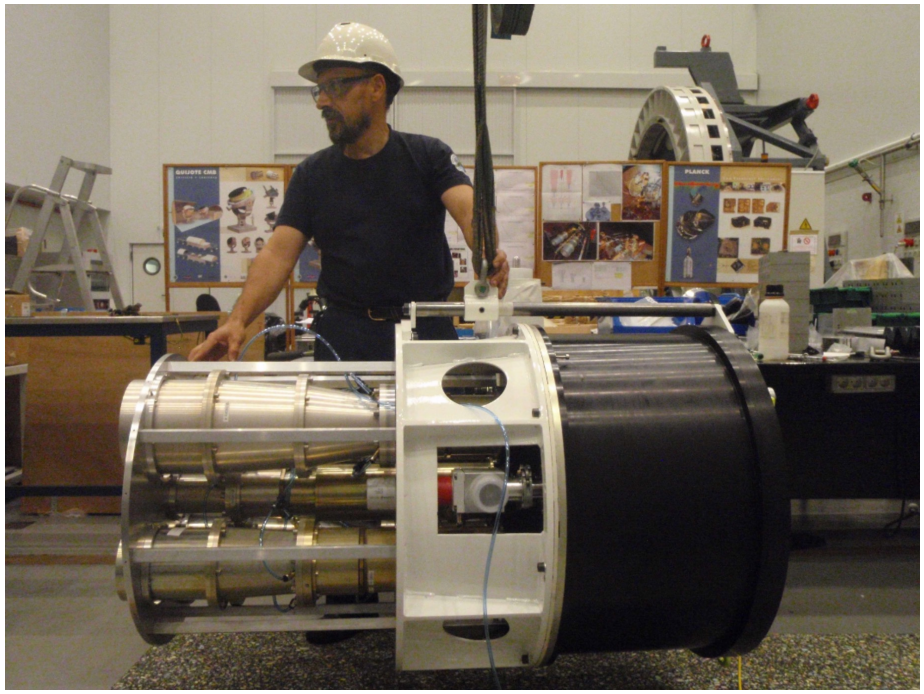
# QUIJOTE CMB

## QT-2 Telescope

# QUIJOTE CMB

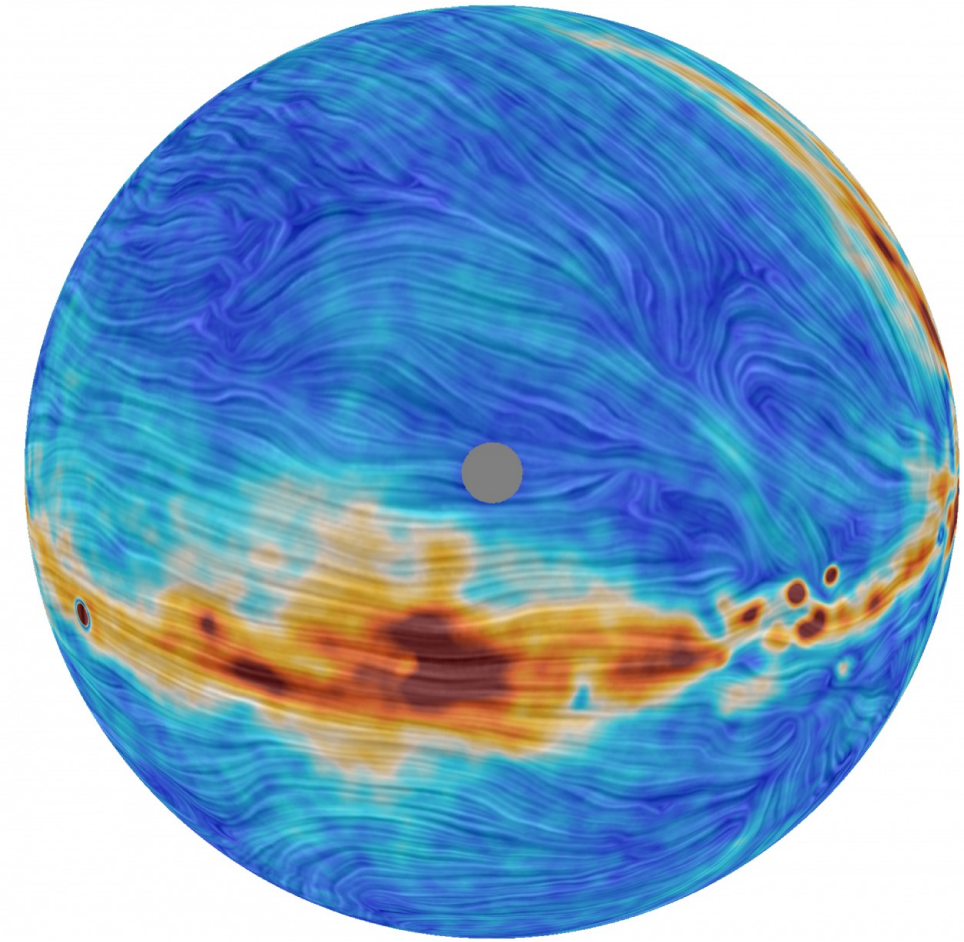
## Multi-frequency Instrument (MFI)





# QUIJOTE CMB

MFI 11GHz - LIC

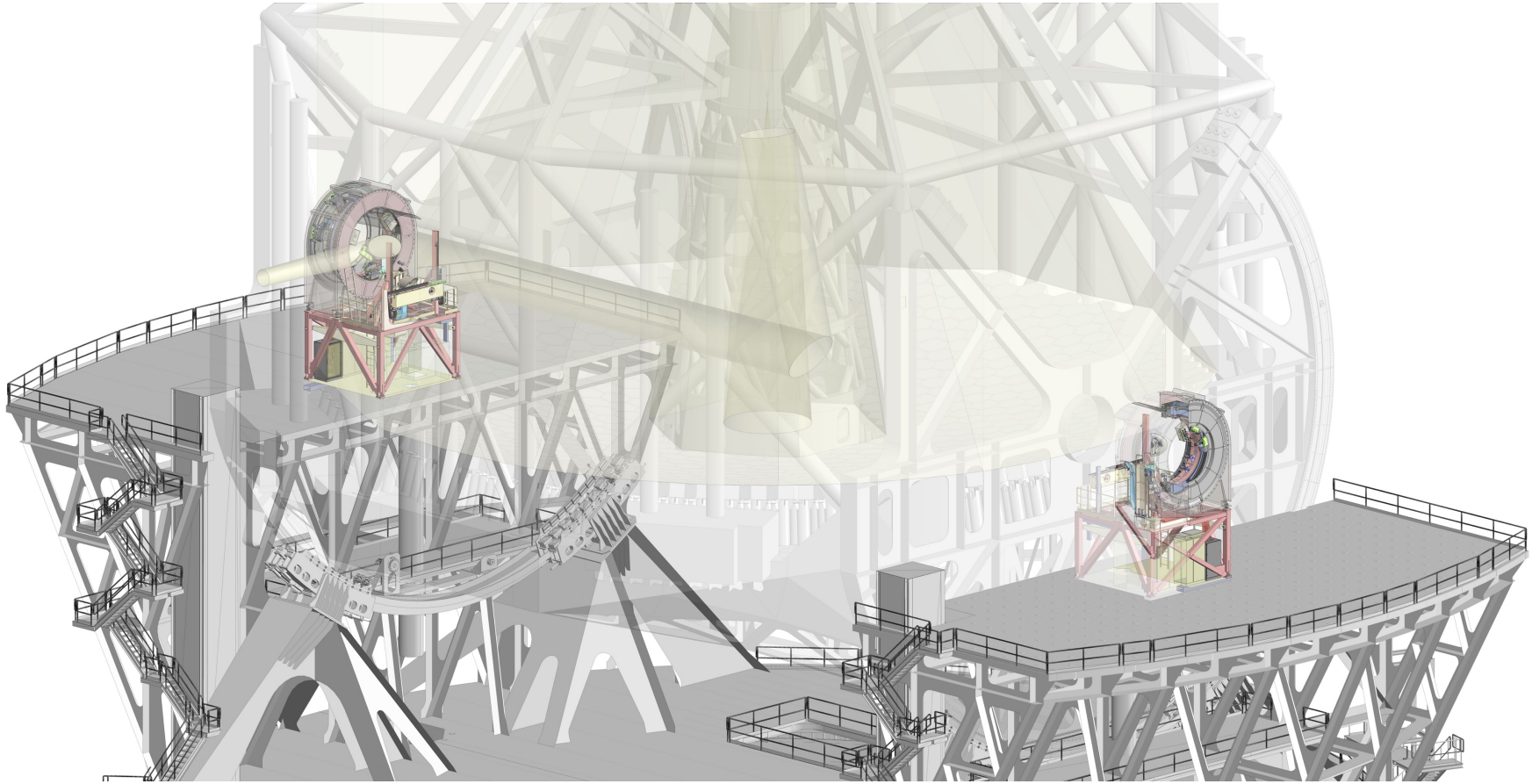


Map of polarized microwave emissions in the sky of Earth's northern hemisphere.
(Image: QUIJOTE Collaboration)

# QUIJOTE CMB

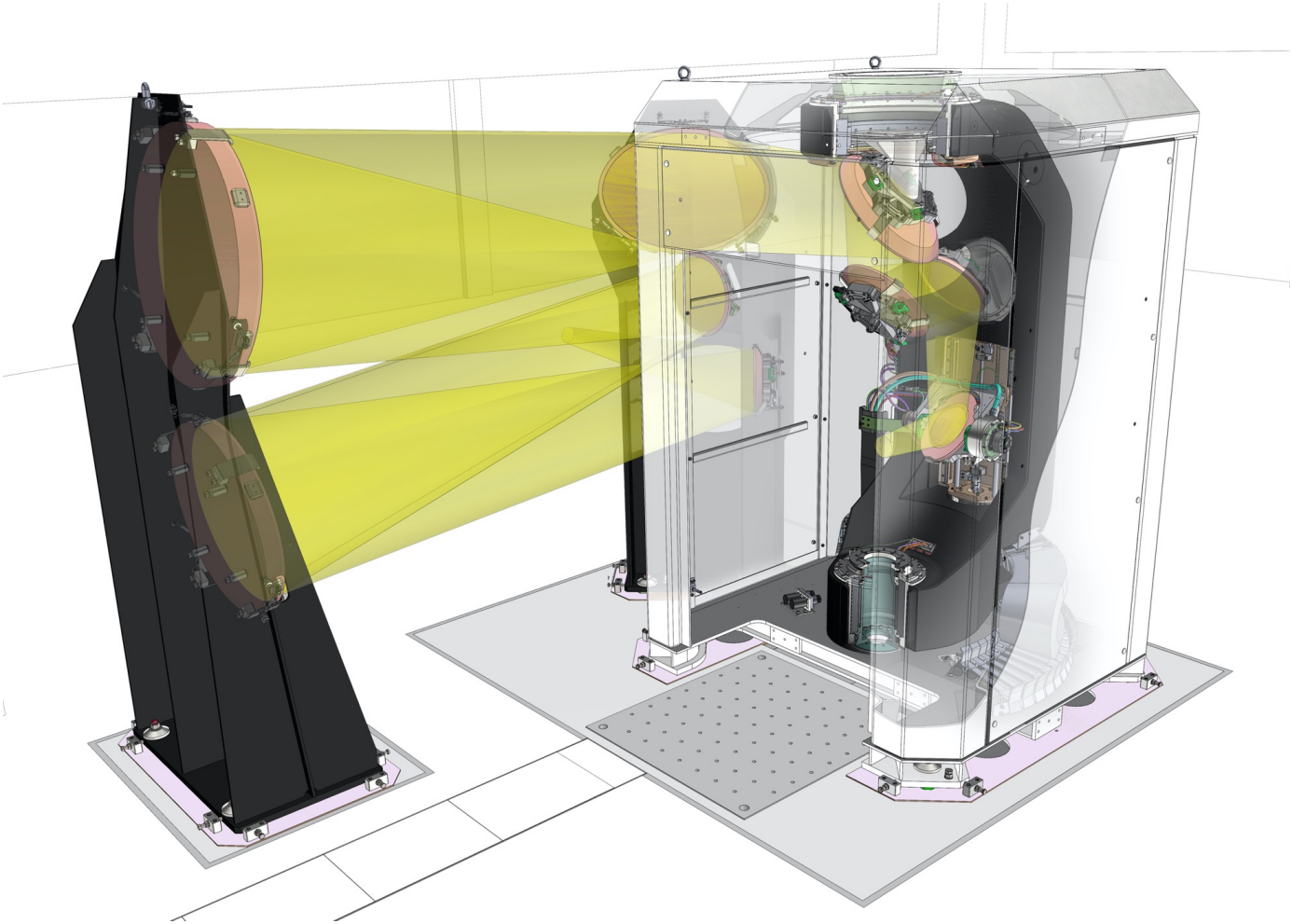

for the detection of
Big Bang
gravitational waves.
El IAC lidera
el Experimento QUIJOTE,
en el Observatorio del Teide (Tenerife),
para la detección de las
ondas gravitacionales
del Big Bang

# ELT Prefocal Stations



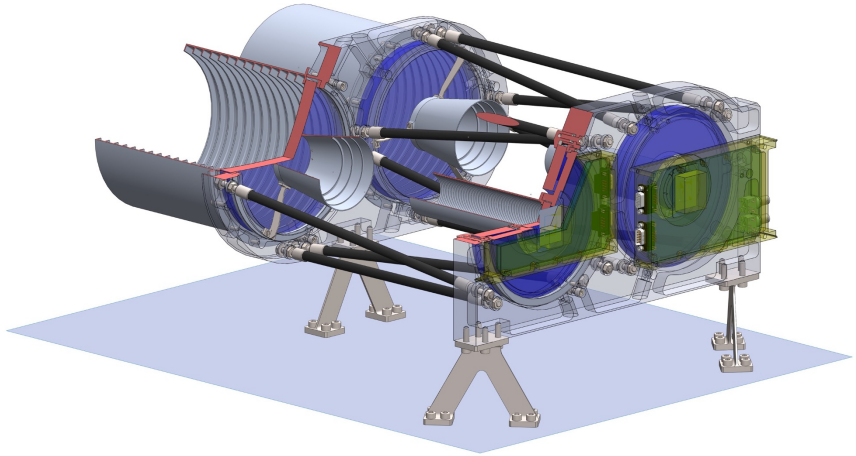
# ELT Prefocal Stations

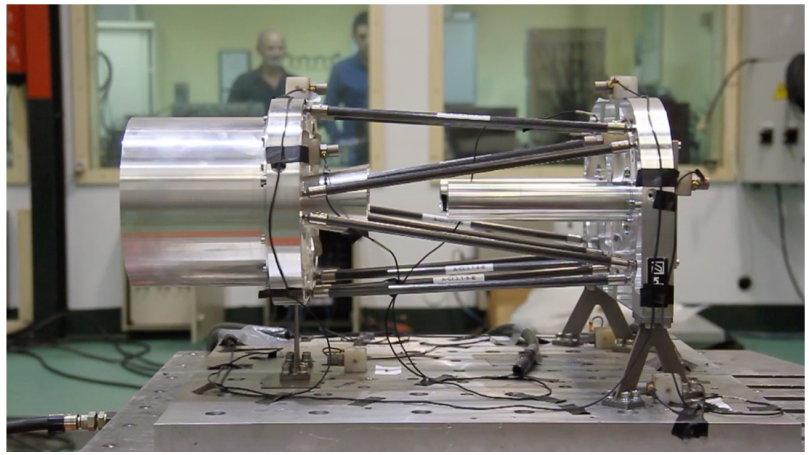
# Dynamic Optical Relay System (DORS)

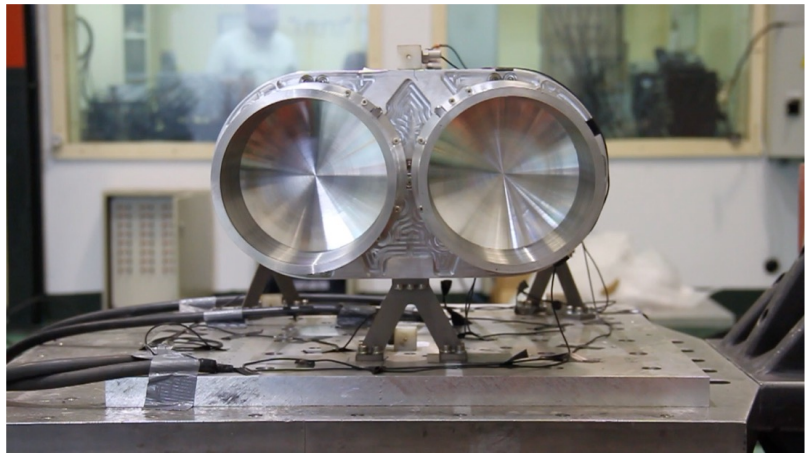


# Dynamic Optical Relay System (DORS)

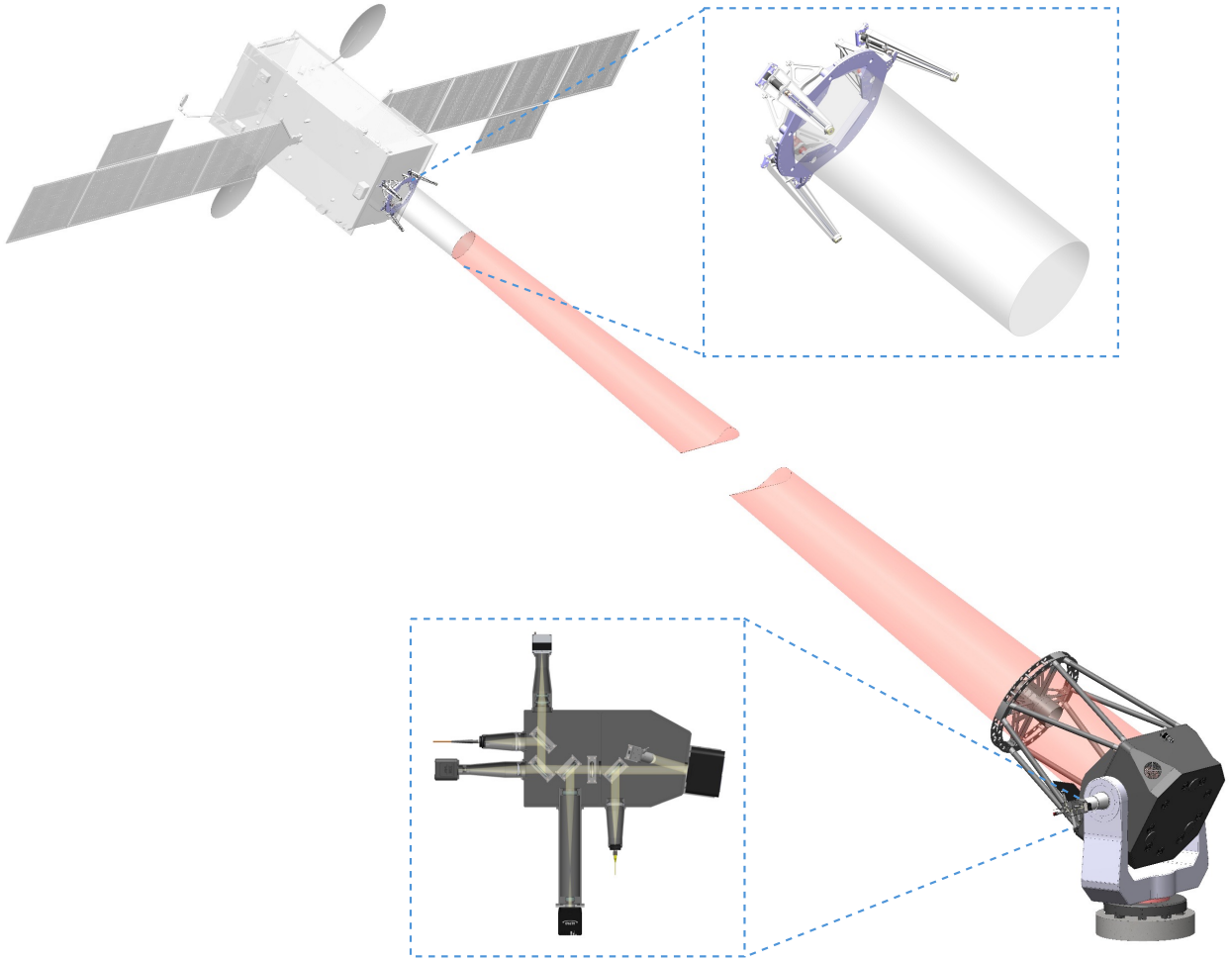
# Optical Payloads



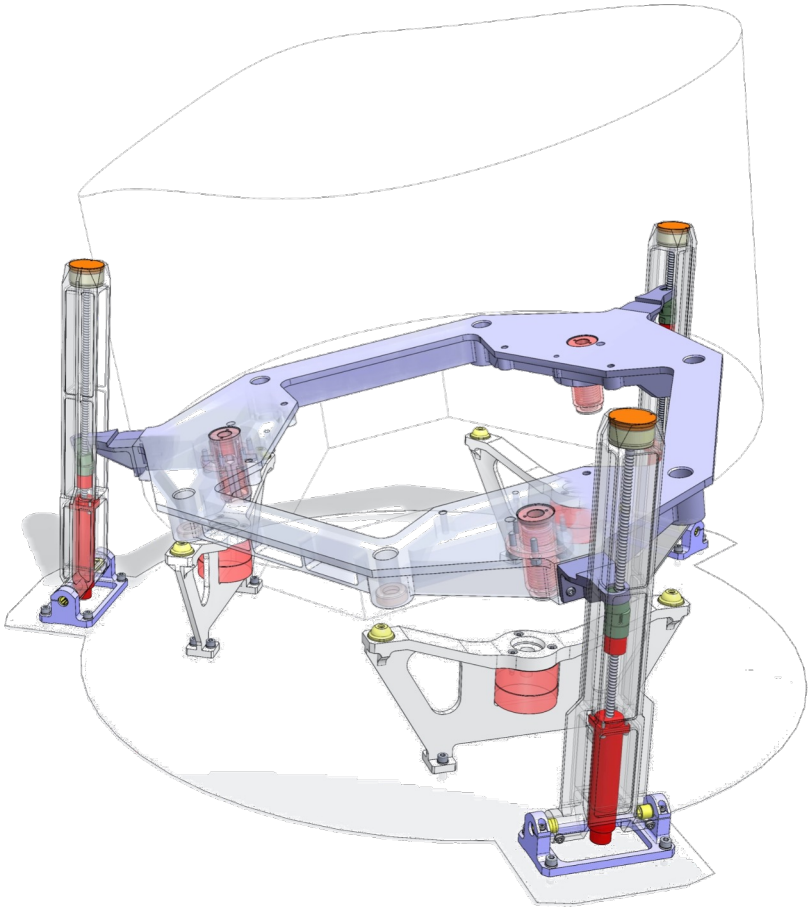




# Optical Communications



# Optical Communications



# Instrument Payload Issues

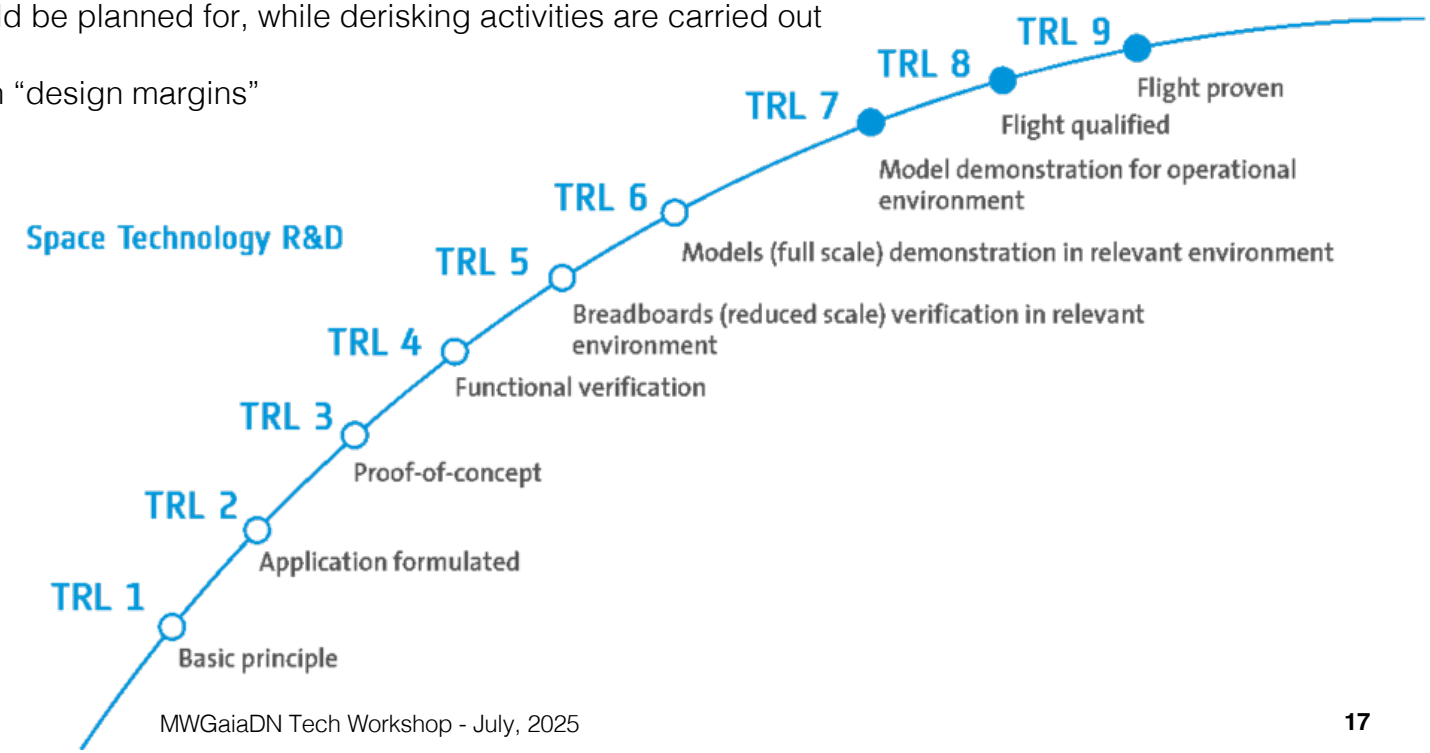
In this kind of Scientific Projects/Missions collaboration between scientist and engineers is crucial to identify the challenges early in the project timeline to address them.

Industrial partners are happy to perform initial assessments of what can reasonably be done and what cannot.

Elements / systems requiring a predevelopment should be matured ahead in time.

Plan Bs for systems with high risk should be planned for, while derisking activities are carried out

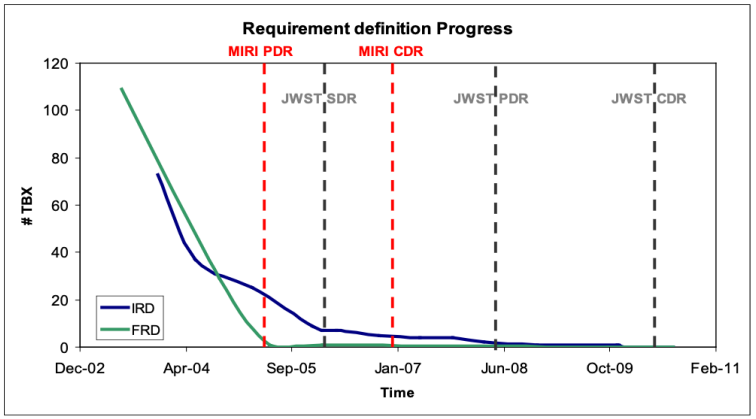
At early stages there should be enough “design margins”



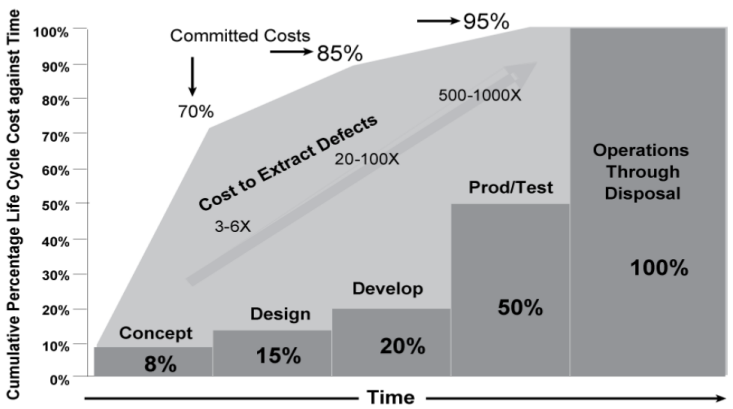
# Instrument Payload Issues

"Early requirement engineering effort reduces cost and development time", José Lorenzo Álvarez

- Common Problem in Scientific Instrument Lifecycle:
  - Different life-cycles scheduling between Spacecraft System and Instrument development.
  - Can lead to (costly) late changes in the instrument design




> EXAMPLE ANALYSIS ON REQUIREMENTS EVOLUTION FOR JWST MIRI INSTRUMENT



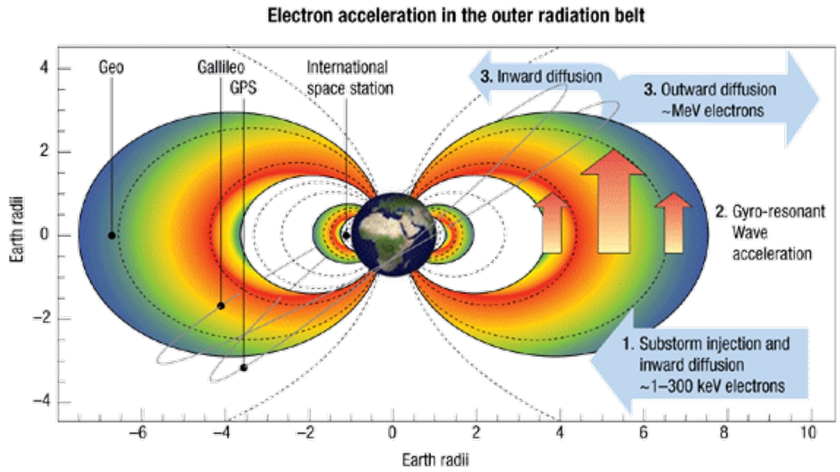

> SOURCE: INCOSE

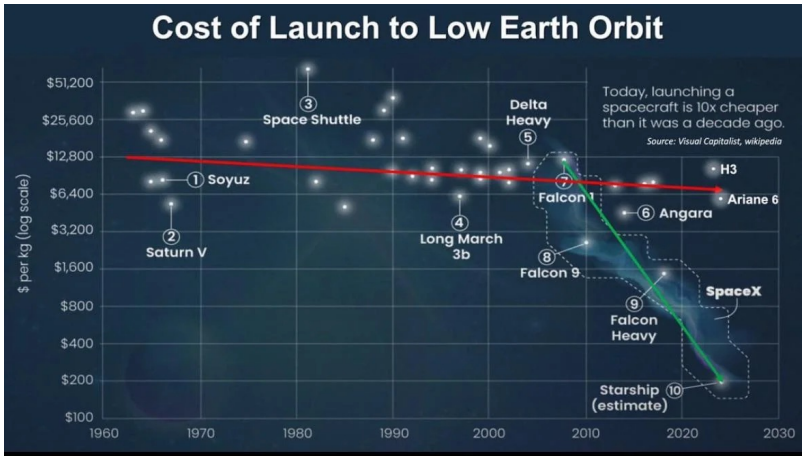
(Credit: José Lorenzo Álvarez)

# Instrument Payload Issues

Space environment, characterized by,
- Vacuum
- No gravity
- Thermal conditions
- Radiation
- Atomic Oxygen
- Micro-meteorites
- Space debris

Additionally, the launch causes,
- Mass/volume limitations
- Strong vibrations

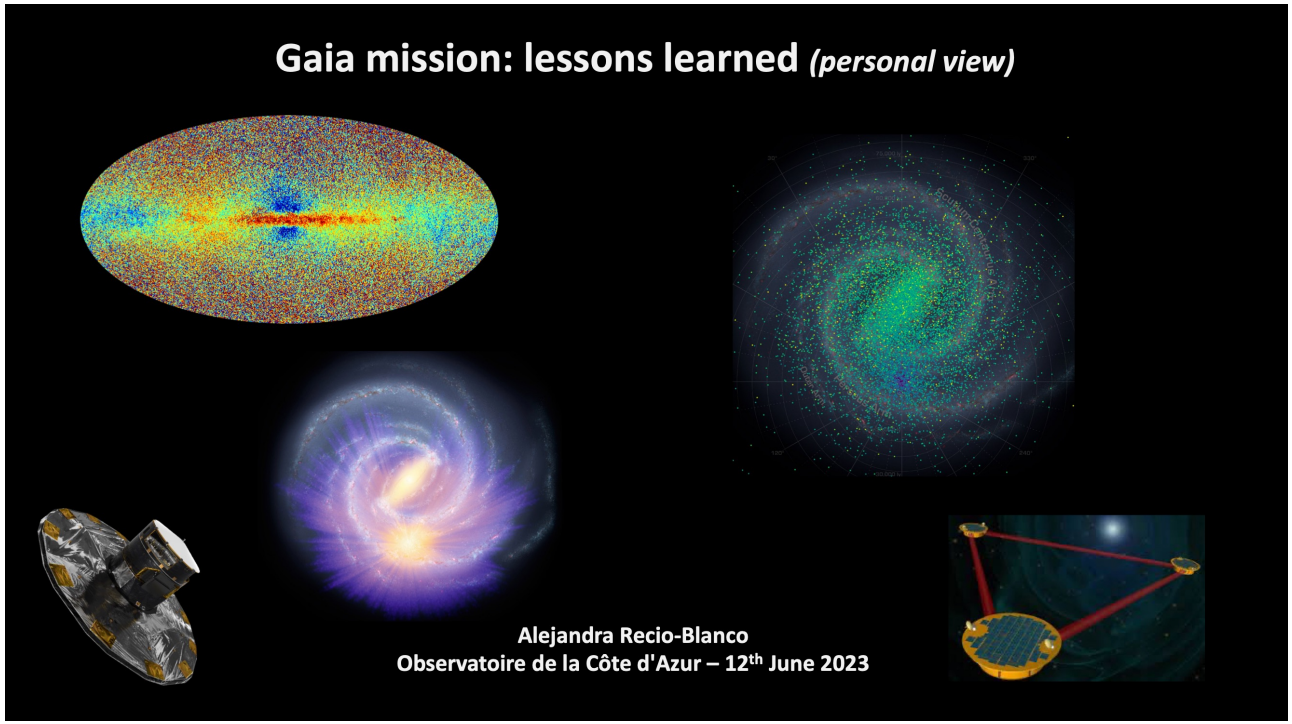


# Instrument Payload Issues

Keep in mind the lessons learned from Gaia Mission.

e.g. Alejandra Recio-Blanco, “Gaia mission: lessons learned (personal view)”



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Thank you for your attention!

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