Q & **U** **B**olometric **I**nterferometer for **C**osmology (QUBIC)

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CLAF-CNRS Latin-American Astro-particle Physics International Research Network

Kick-off Meeting

15/04/2026

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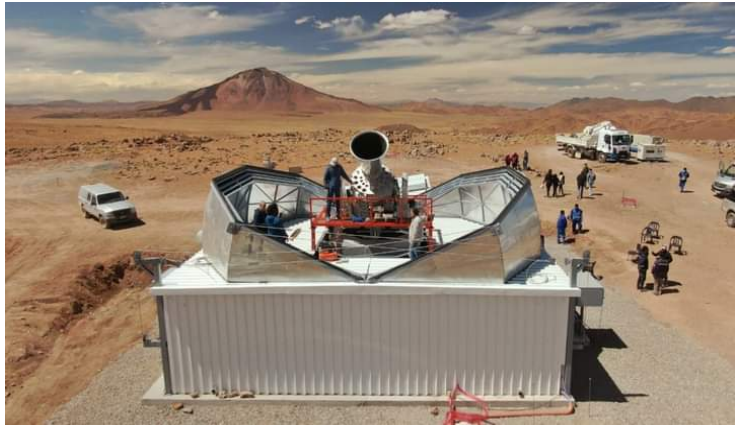
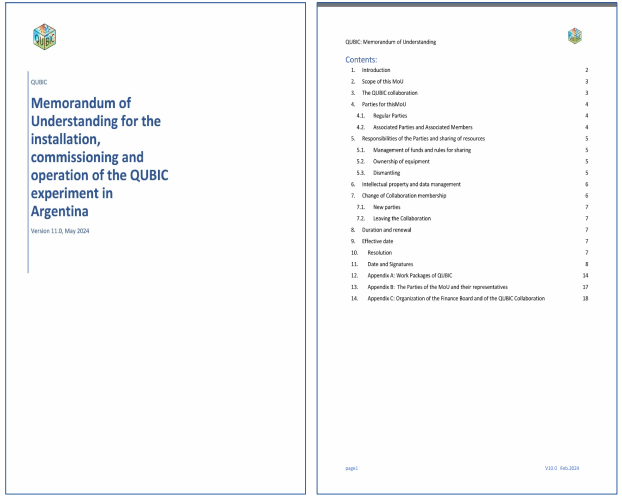


- **POLARIZATION OF COSMIC MICROWAVE BACKGROUND**
  - ✓ CUTTING EDGE TECHNOLOGY (BOLOMETER+INTERFEROMETER)
- **6 COUNTRIES (ARGENTINA, FRANCE, IRELAND, ITALY, UK, USA), OVER 30 SCIENTISTS**
  - ✓ COOPERATION BY THIRD PARTIES AS "ASSOCIATED COUNTRIES/INSTITUTIONS"
- **PROTOTYPE INSTALLED AT OBSERVATION SITE IN 2022 (SALTA, AR)**
  - ✓ FIRST LIGHT IN 2026 TO OPERATE UNTIL 2027/2028

Milestones:

- 2020 Technology Demonstrator (TD), integrated and operated in APC Paris
- July 2021 Shipment to Argentina
- Sept 2021- Sept 2022 test and re-integration in Salta city (Laboratory)
- Nov 2022 Installation at site (Alto Chorrillos)
- Nov 2024 Installation Calibration Tower at site
- 2025 MoU signed, Mount upgrade and first light
- 2026 first Moon scan



QUBIC

Memorandum of Understanding for the installation, commissioning and operation of the QUBIC experiment in Argentina

Version 11.0, May 2024

QUBIC: Memorandum of Understanding

Contents:

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MoU (2025):

SICyT
CNEA
CONICET
Gob. Salta

CNRS (Francia)
INFN (Italia)

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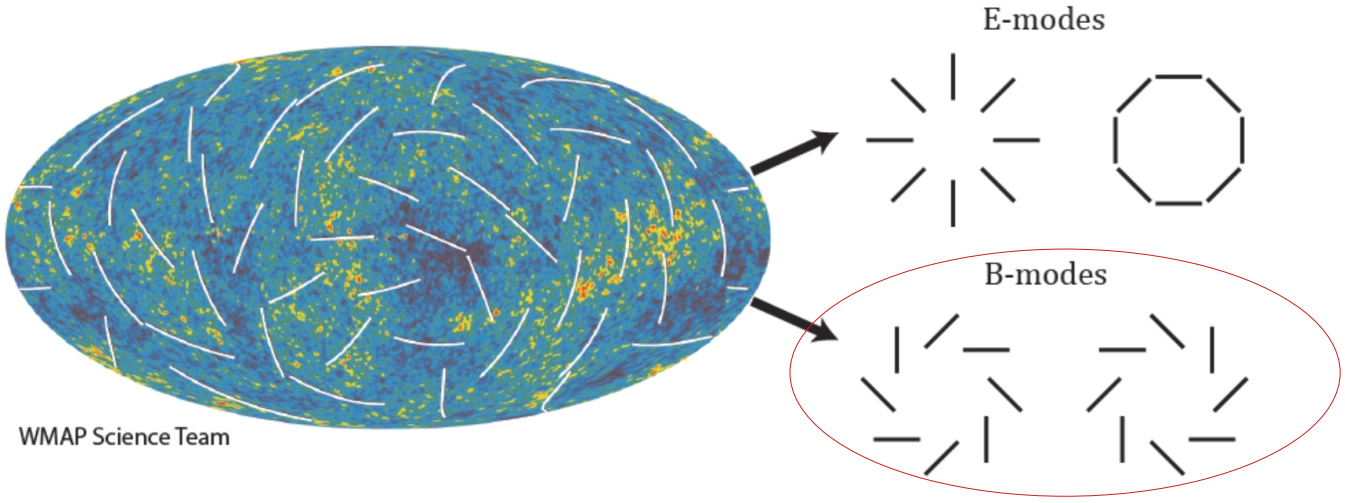
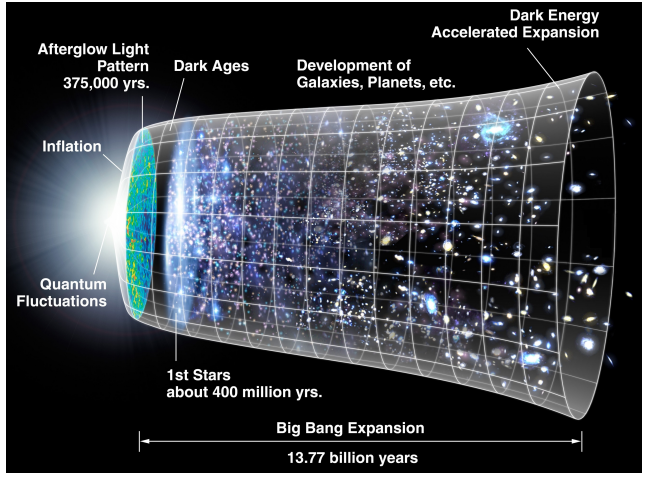
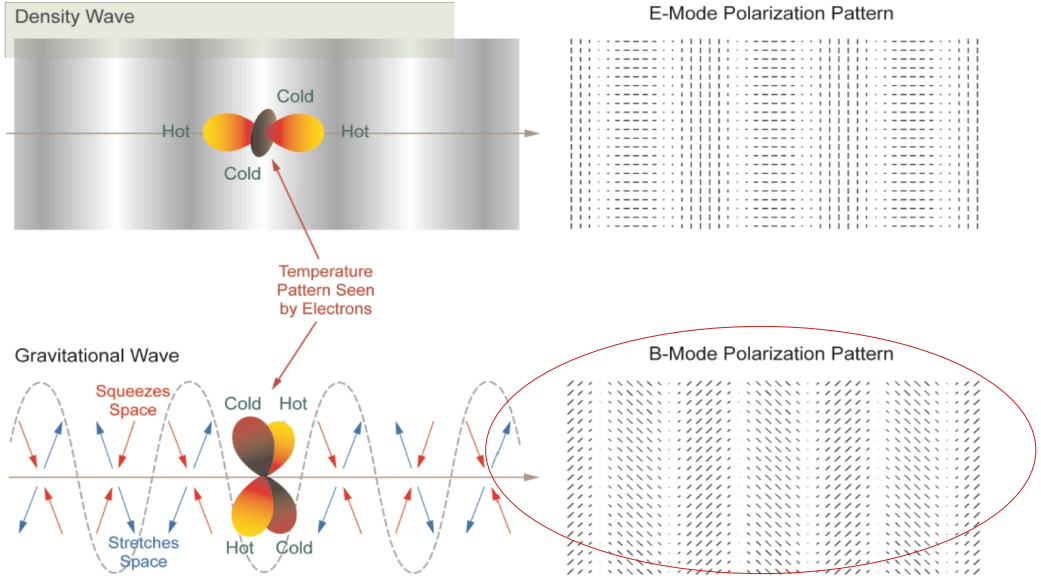
QUBIC scientific goal: measure the CMB B-Mode







During exponential expansion of the Universe (Inflation period) intense gravitational waves are generated.

Tensor fluctuations produce B-Modes while density -scalar- fluctuations do not.

B-Modes never observed

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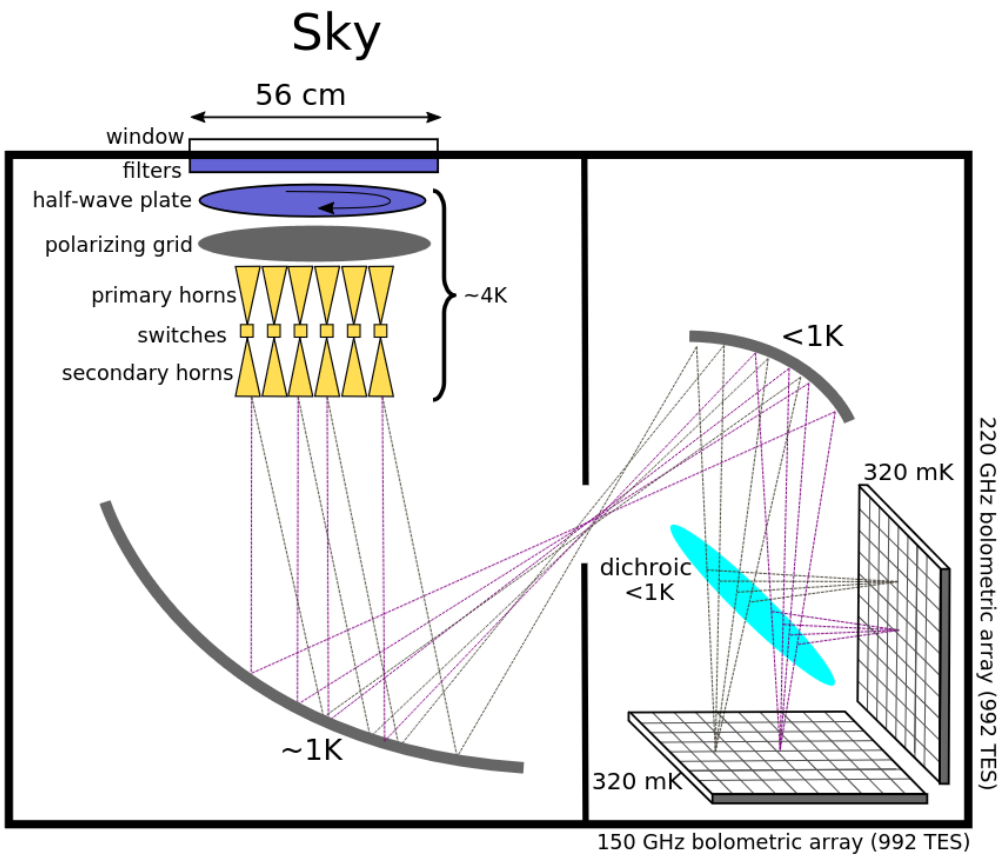
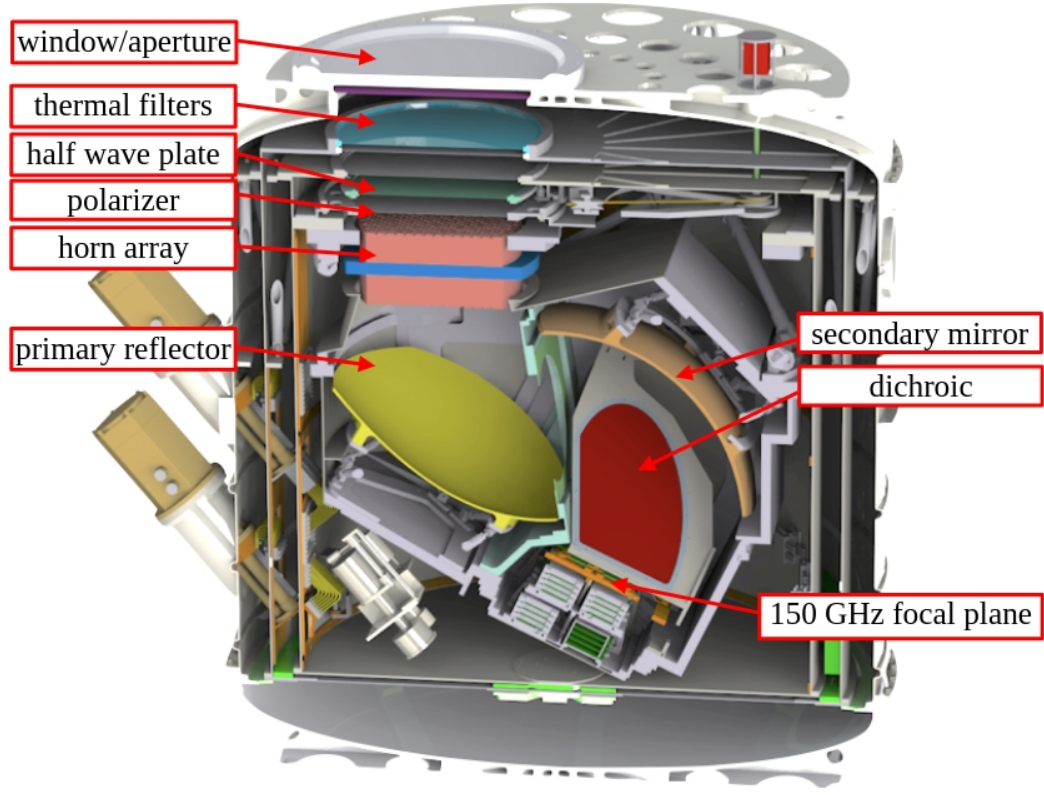
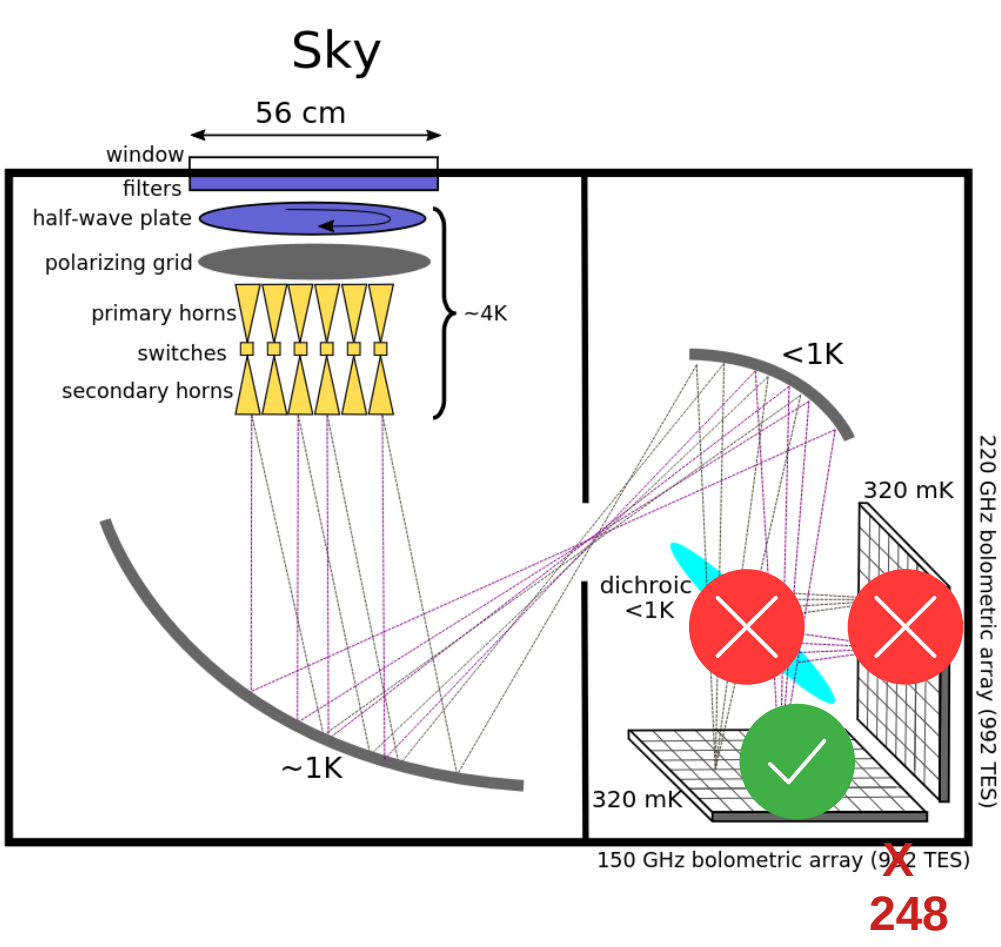
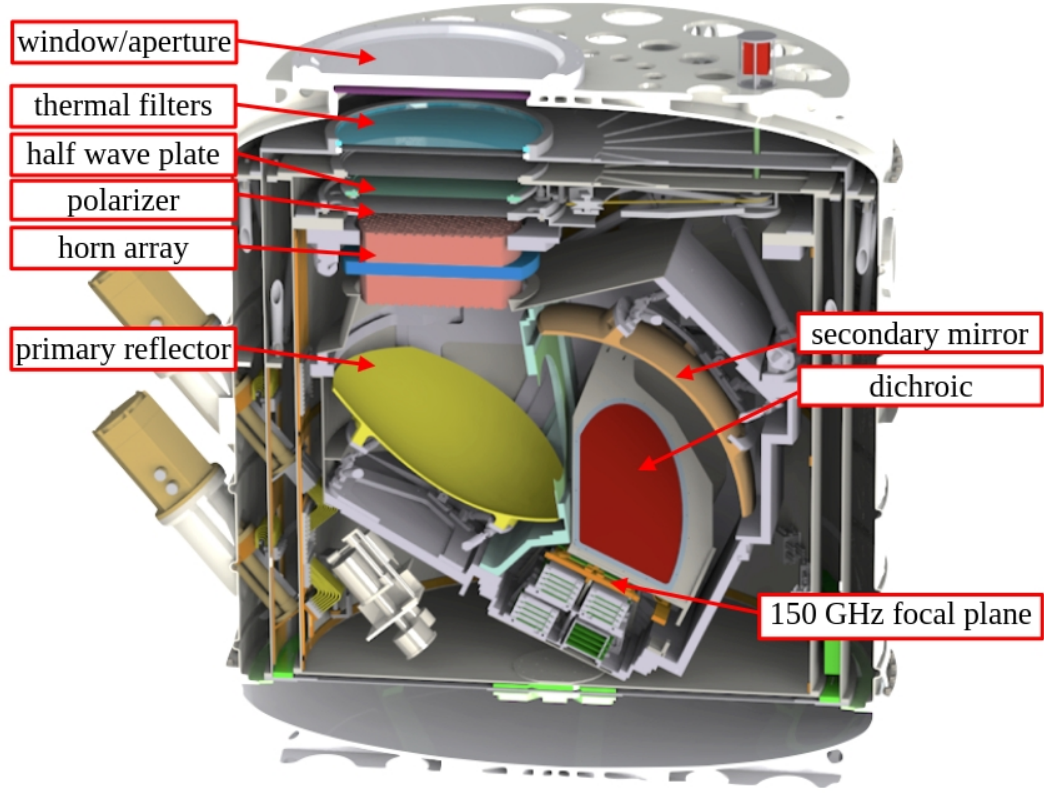
QUBIC Instrument: Final Instrument (FI, planned)





QUBIC Instrument: Technical Demonstrator (TD, ongoing)

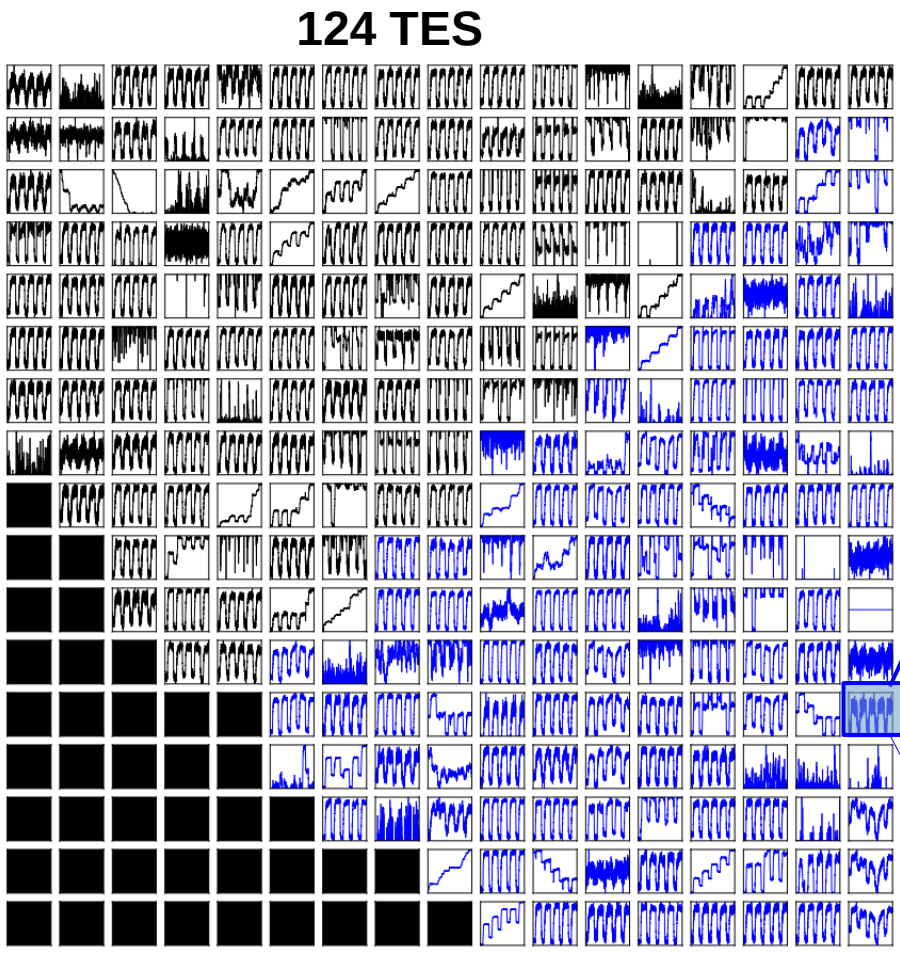




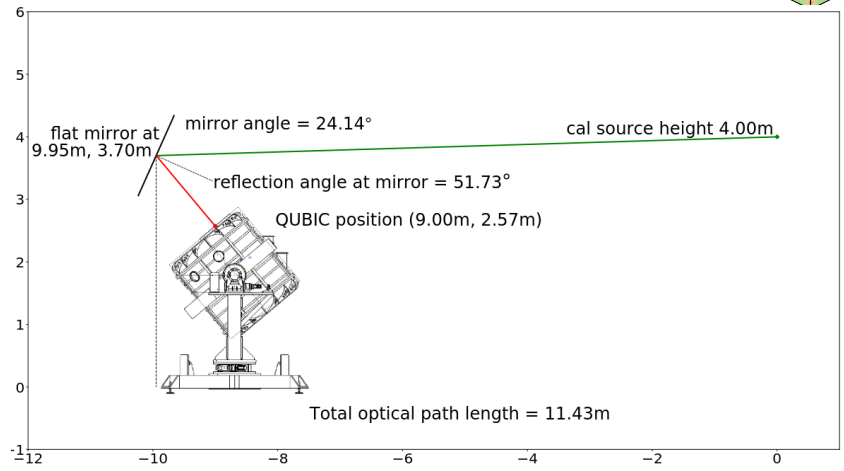
QUBIC Instrument: Technical Demonstrator (TD, ongoing) Vs Final Instrument

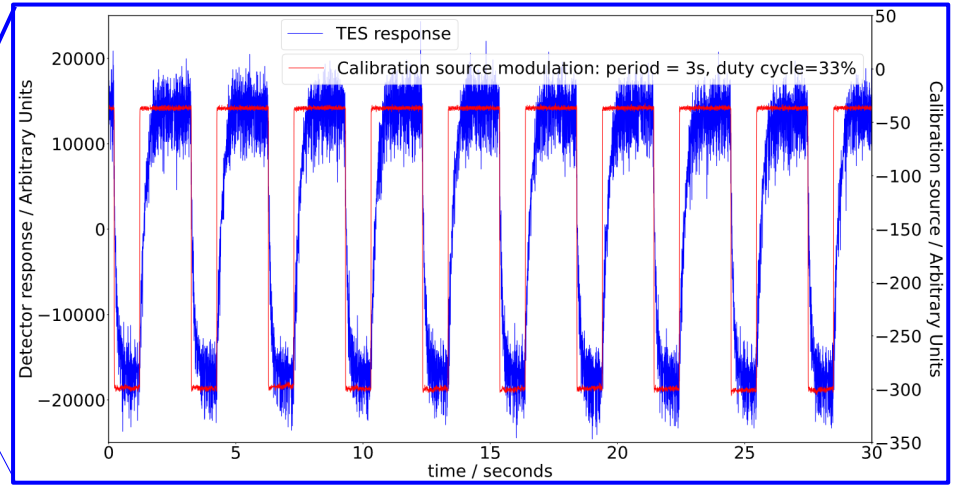
Parameter	QUBIC-TD	QUBIC-FI
Frequency channels	150 GHz	150 GHz & 220 GHz
Frequency range 150 GHz	[131-169] GHz	[131-169] GHz
Frequency range 220 GHz	-	[192.5-247.5] GHz
Window Aperture [m]	0.56	0.56
Number of horns	64	400
Number of detectors	248	992×2
Detector noise [$W/\sqrt{Hz}$]	2.05×10^{-16}	4.7×10^{-17}
Focal plane temp. [mK]	300	300
Sky Coverage	1.5%	1.5%
Synthesized beam FWHM [degrees]	0.68	0.39 (150 GHz), 0.27 (220 GHz)

Technical Demontrator: individiual TES performance (lab. measurements)



124 TES





- JCAP04(2022) 034.
- arXiv:2409.18698 [astro-ph.CO].

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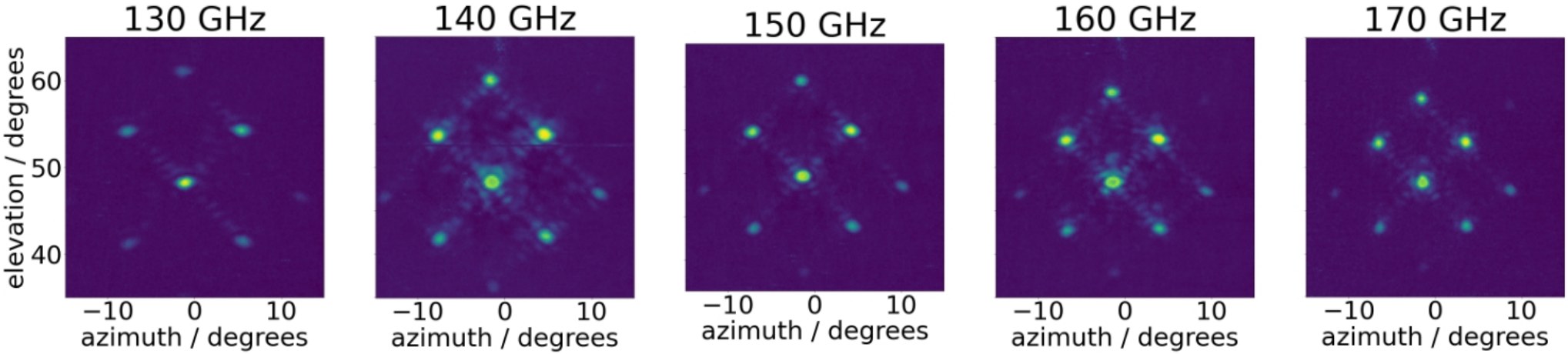
Technical Demontrator: individiual TES synthesized beam reconstruction (lab. measurements)

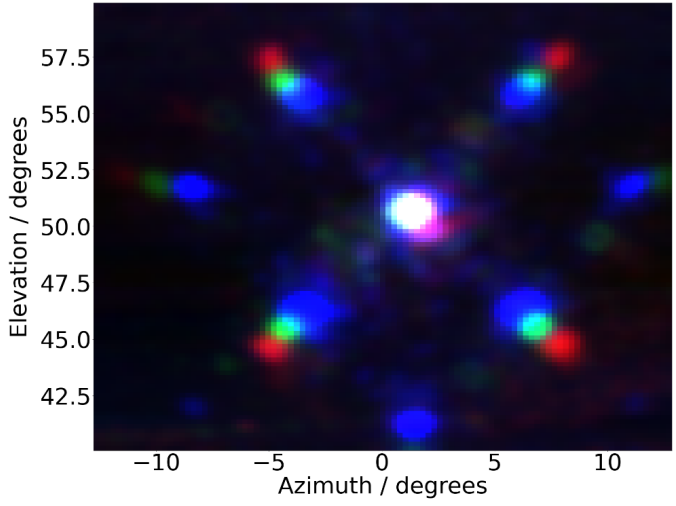
QUBIC-TD synthesized beam maps were measured at five frequencies in the range 130 GHz to 170 GHz

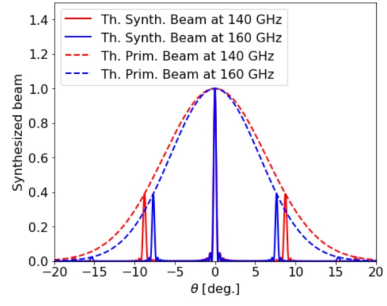


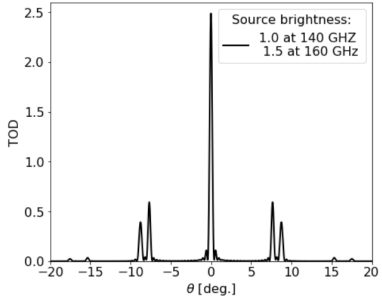
Procedure:

1. point at fixed elevation angle and scan across azimuth from −25º to +25º. Then increases the elevation and perform a new azimuth scan.

2. After scanning each TES produces a synthesized map (function of frequency)







- JCAP04(2022) 034.
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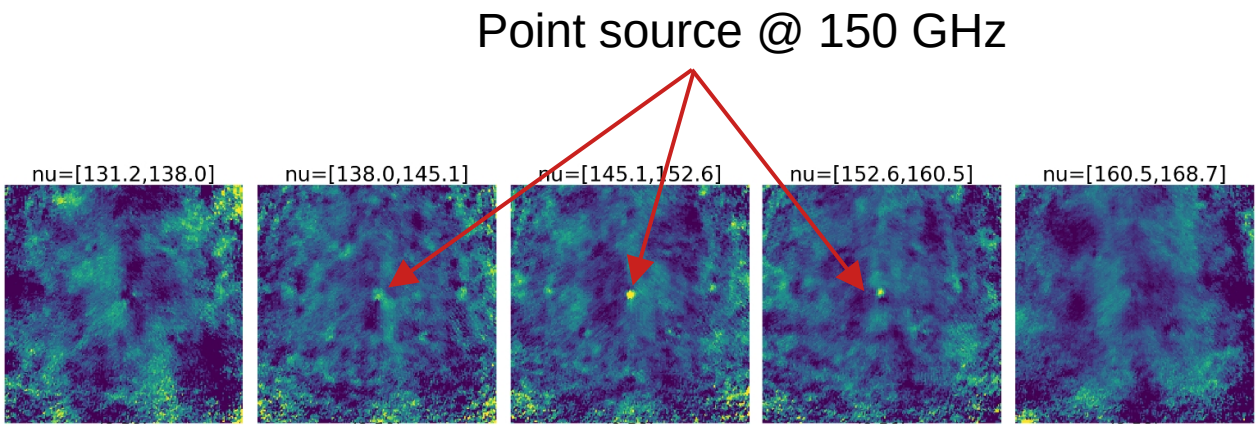
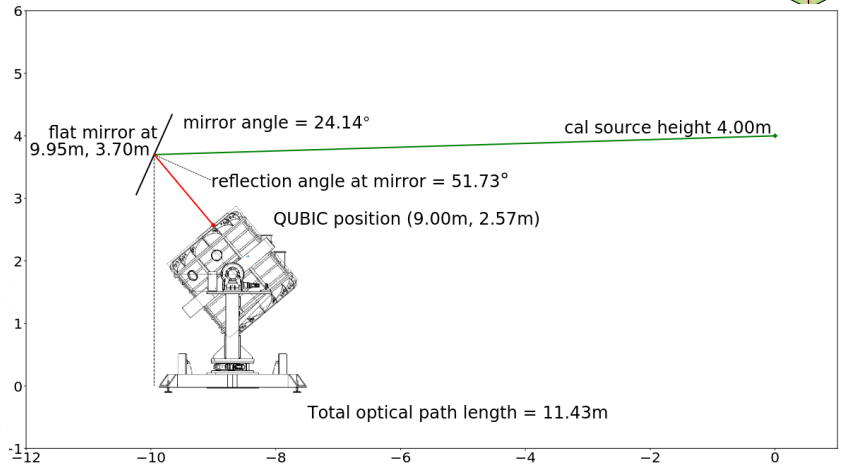
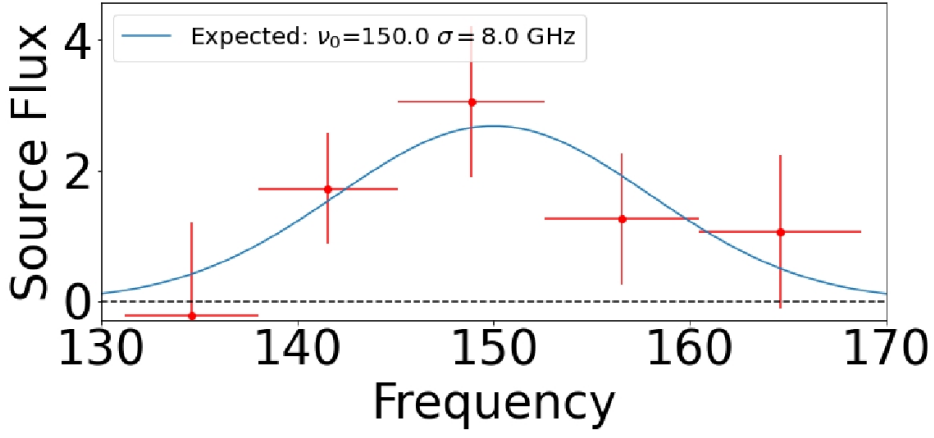
Technical Demontrator: sky-map reconstruction (lab. measurements)



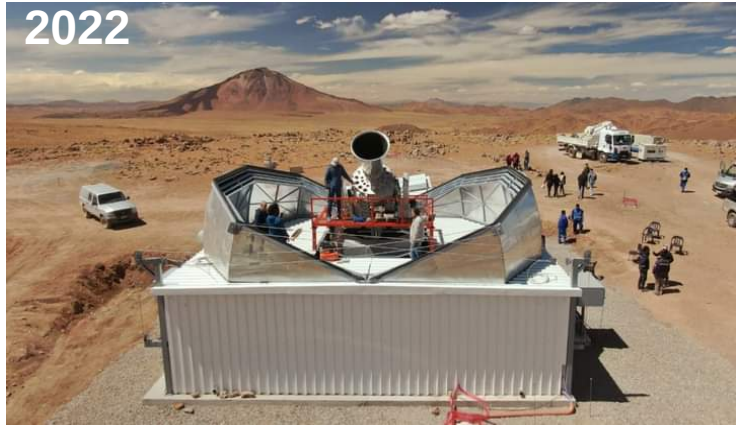




- Artificial source scanned across the source in azimuth and elevation.
- Synthesized beam for each TES modeled through a series of Gaussian profiles scaling linearly with wavelength.

The successful mapmaking with the measured synthesized beam is effectively an end-to-end checkout of the entire system

Technical Demontrator: from laboratoy to installation at site (~5000m above sea level)



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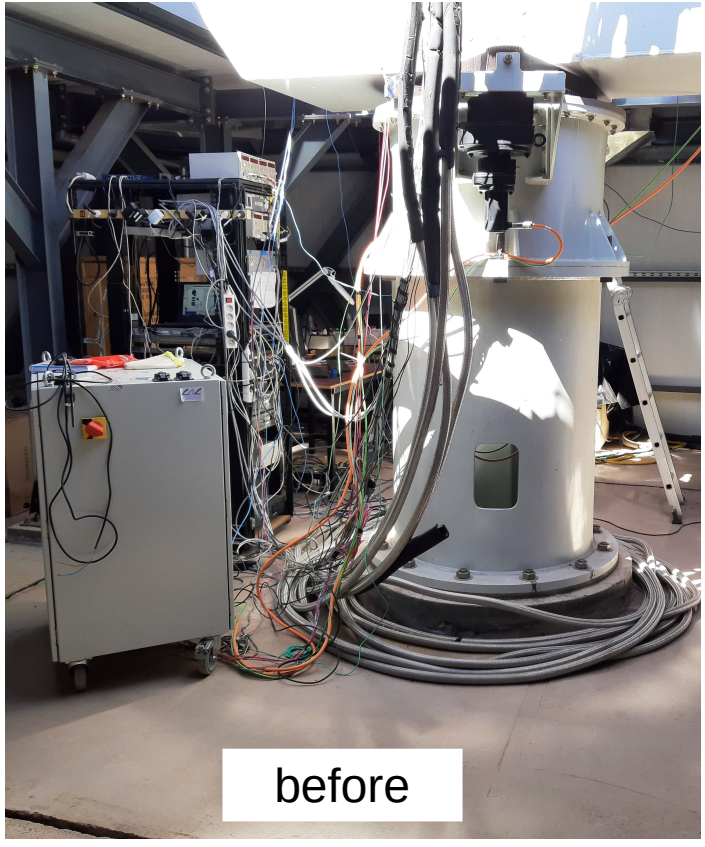
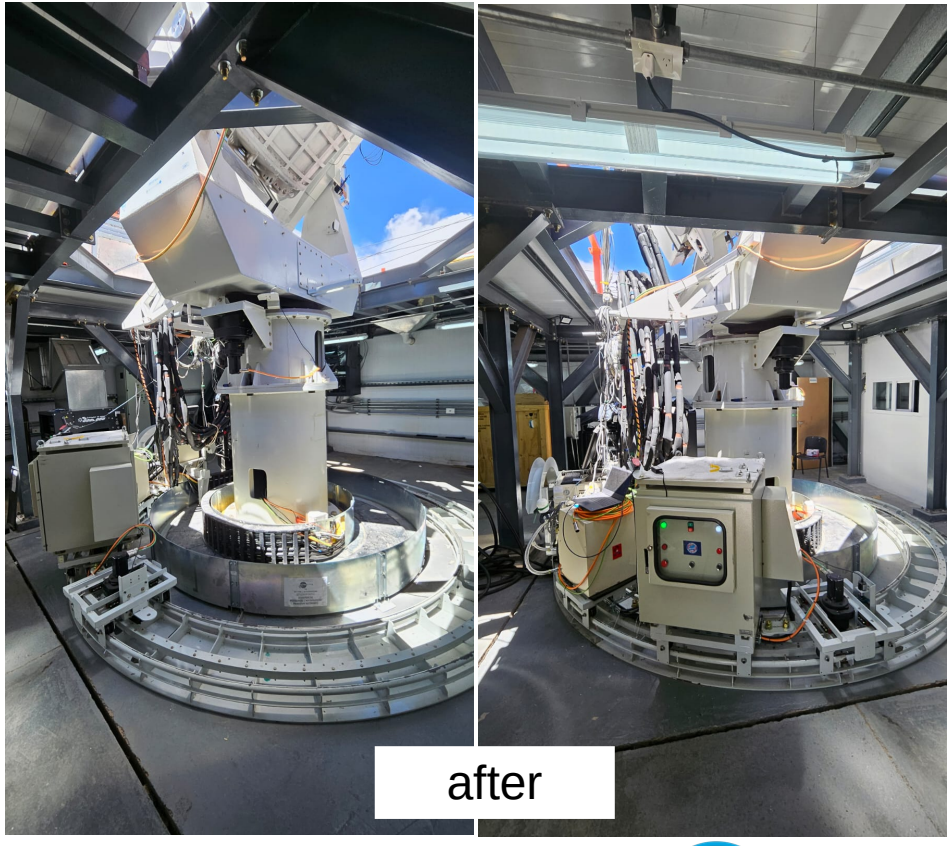
Technical Demontrator: from laboratoy to installation at site (~5000m above sea level)

Installation of cable carrier Oct/Nov 2025





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Technical Demontrator: from laboratoy to installation at site (~5000m above sea level)

snowstorms hamper regular data taking (among other difficulties)

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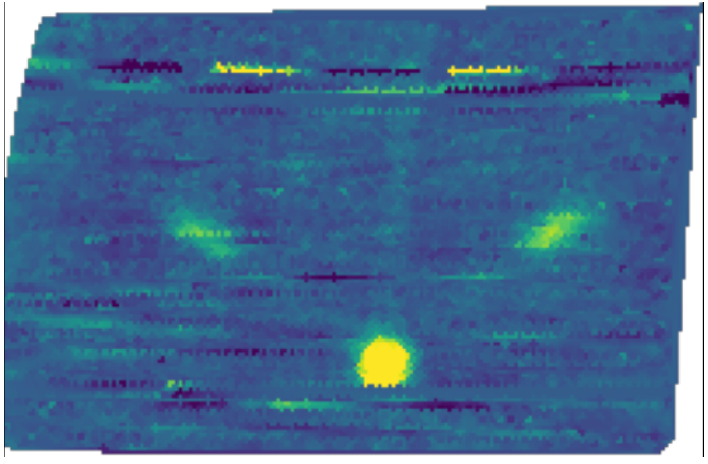
11 March 2026 (analysis ongoing) Moon scan for the first time at site!



Much more to come in the following months!

Thank you