

Q & U Bolometric Interferometer for Cosmology (QUBIC)



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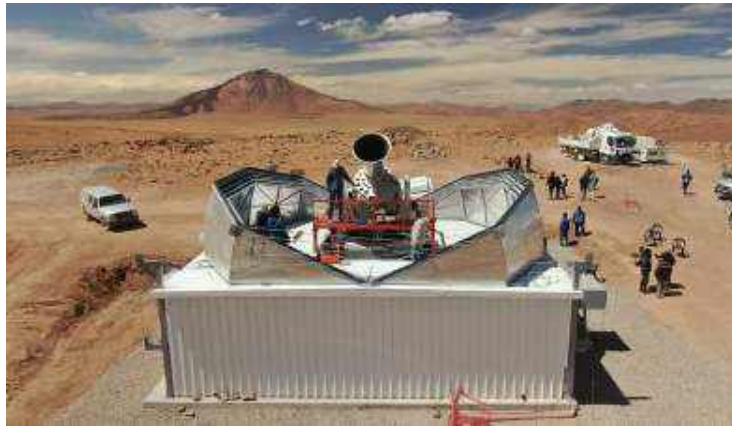
CLAF-CNRS Latin-American Astro-particle Physics International Research Network

Kick-off Meeting

15/04/2026



Q & U Bolometric Interferometer for Cosmology (QUBIC)



- **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



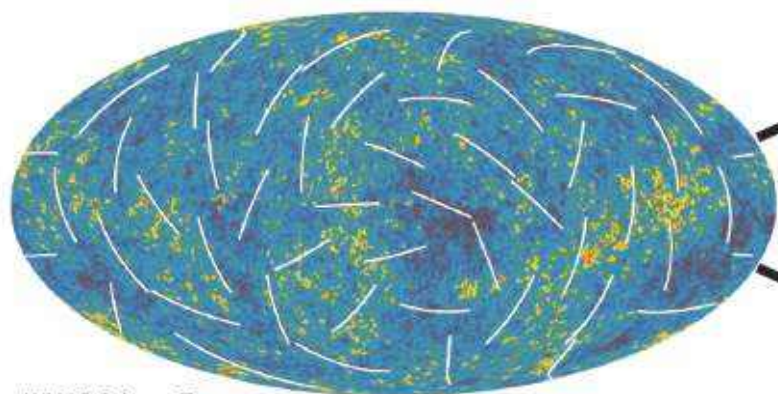
MoU (2025):

SICyT
CNEA
CONICET
Gov. Salta

CNRS (Francia)
INFN (Italia)

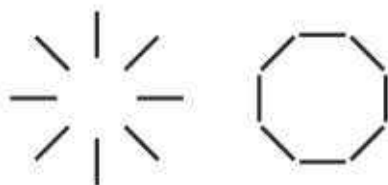


QUBIC scientific goal: measure the CMB B-Mode

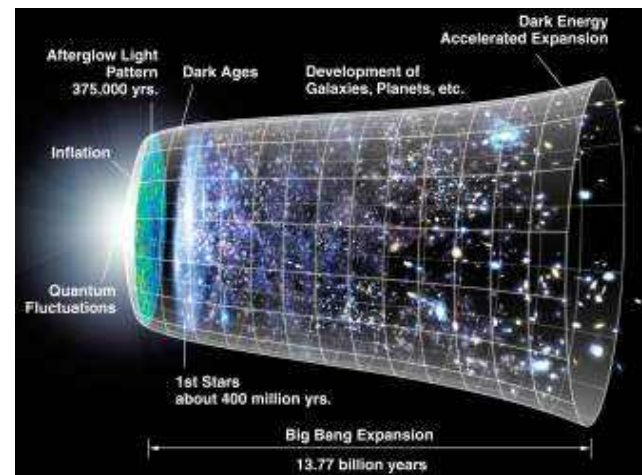
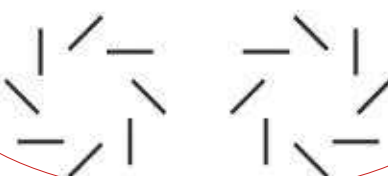


WMAP Science Team

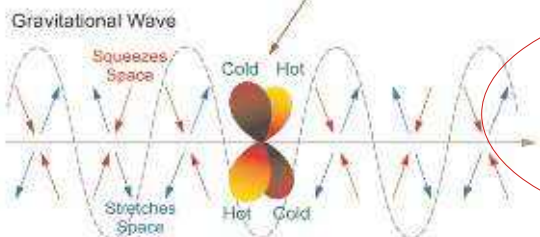
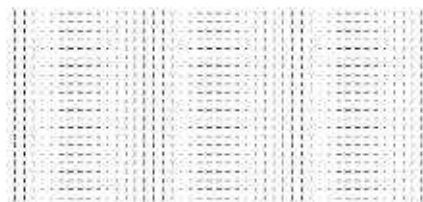
E-modes



B-modes



E-Mode Polarization Pattern



B-Mode Polarization Pattern



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

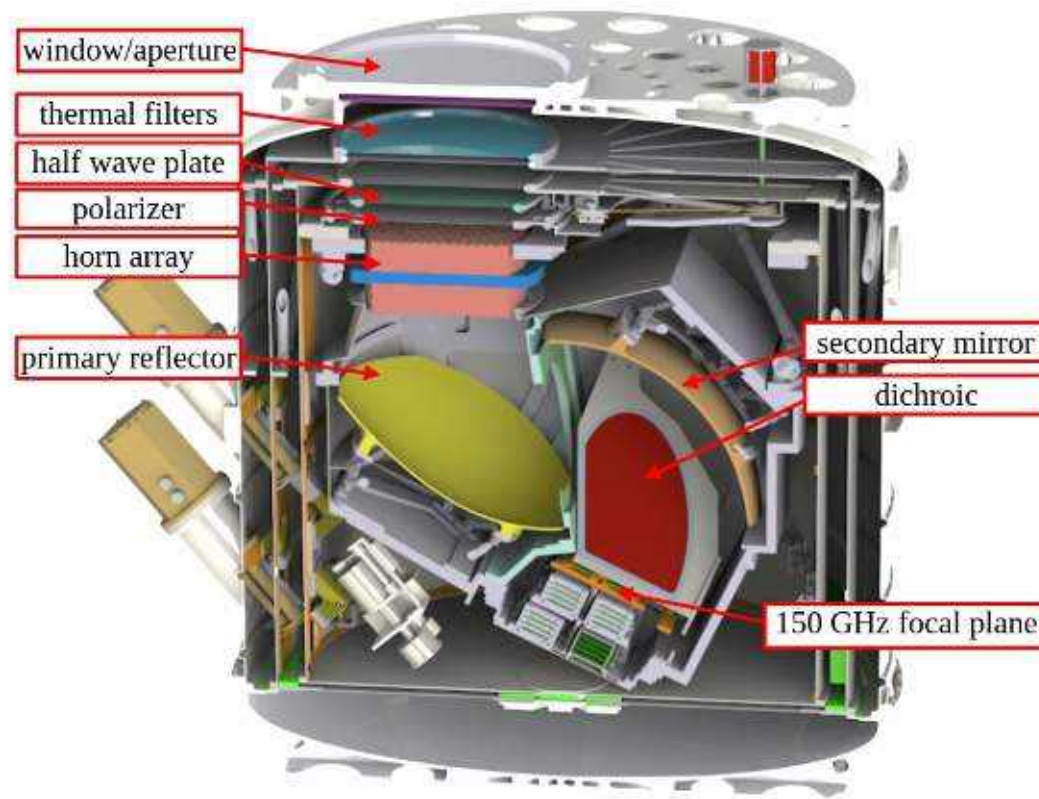
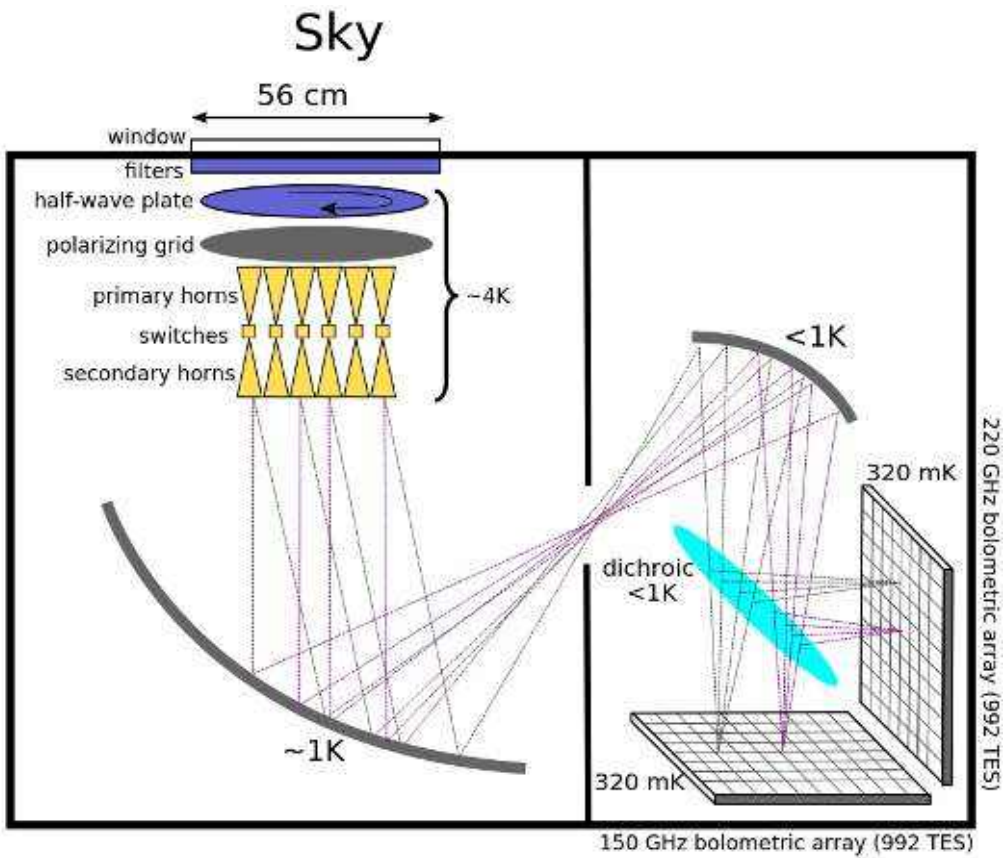
Tensor fluctuations produce B-Modes while density -scalar- fluctuations do not.

B-Modes never observed

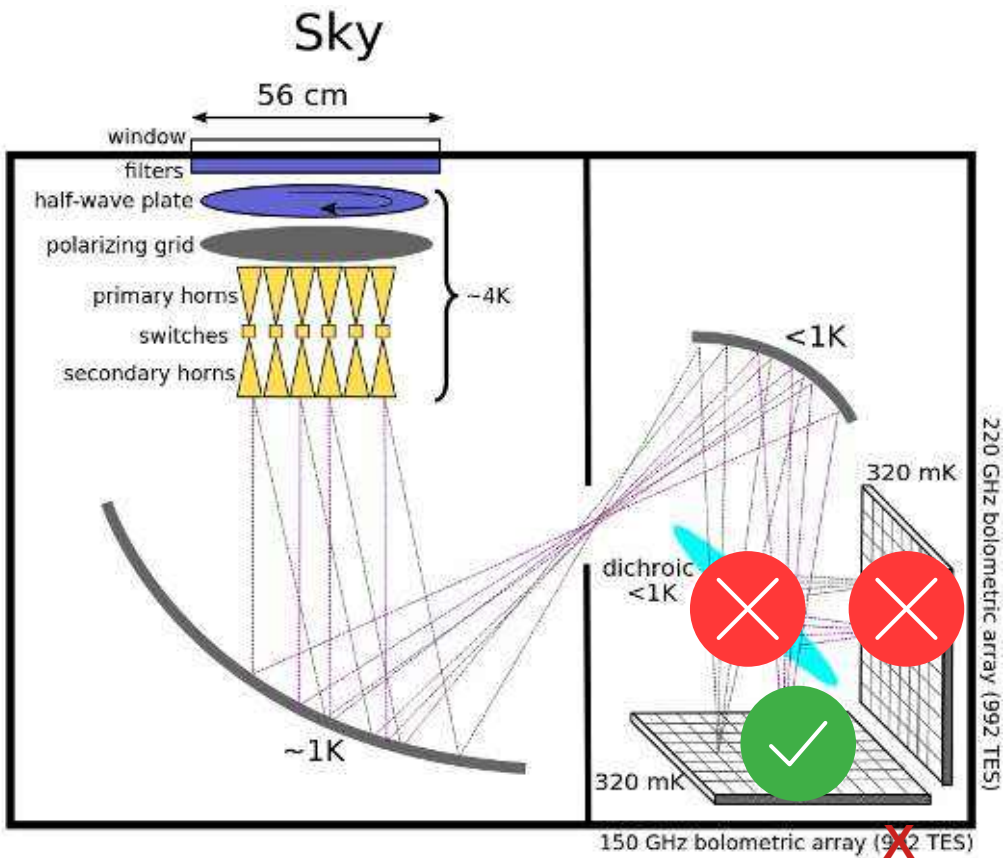




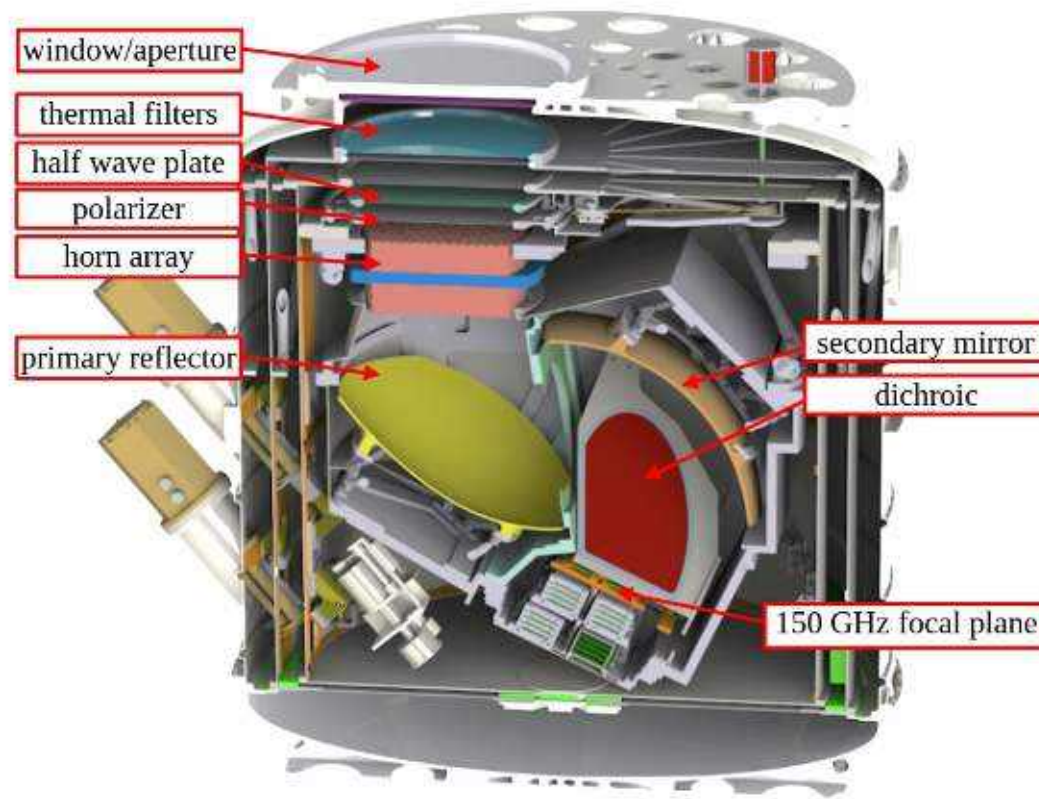
QUBIC Instrument: Final Instrument (FI, planned)



QUBIC Instrument: Technical Demonstrator (TD, ongoing)



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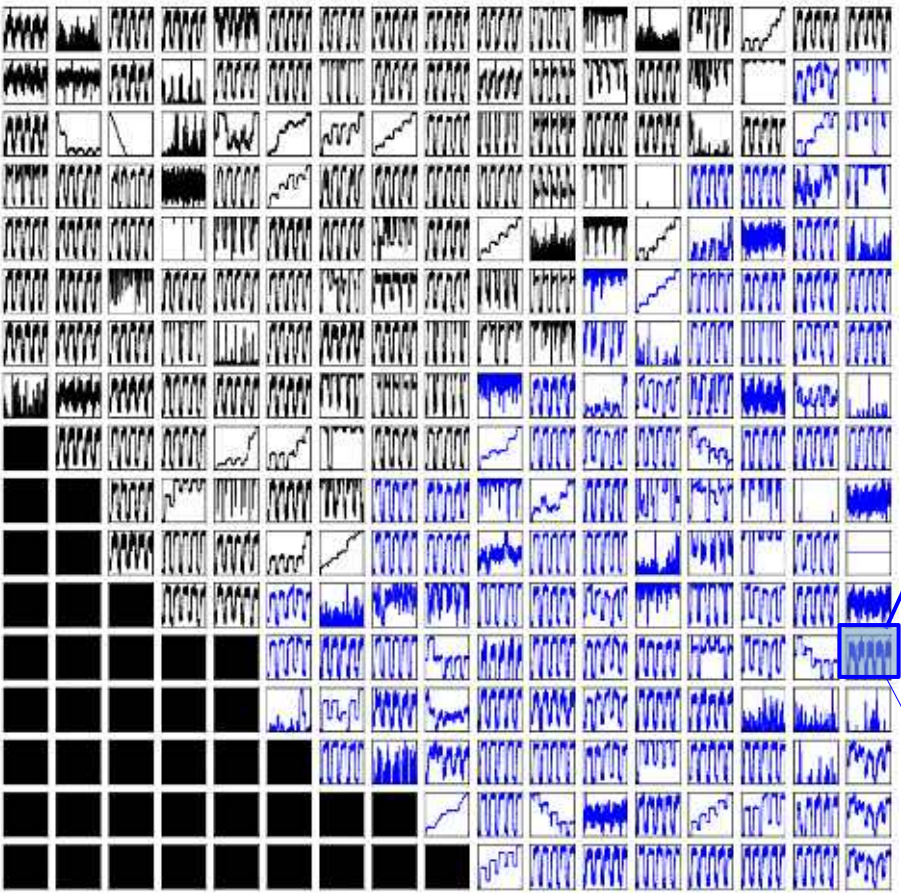


Parameter	QUBIC-TD	QUBIC-FI
Frequency channels	150 GHz	150 GHz & 220 GHz
Frequency range 150 GHz	[131-169] GHz	[131-169] GHz
Frequency range 220 GHz	-	[192.5-247.5] GHz
Window Aperture [m]	0.56	0.56
Number of horns	64	400
Number of detectors	248	992×2
Detector noise [W/\sqrt{Hz}]	2.05×10^{-16}	4.7×10^{-17}
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)

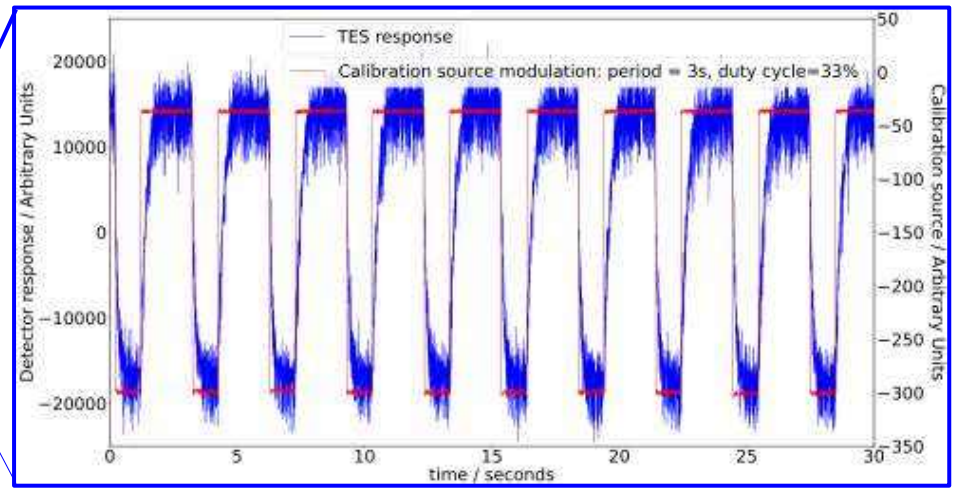
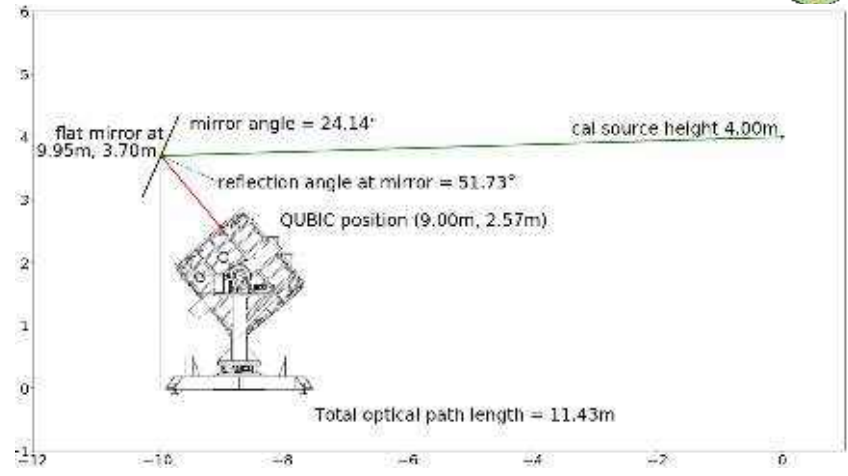


Technical Demonstrator: individual TES performance (lab. measurements)

124 TES



124 TES



- JCAP04(2022) 034.
 - [arXiv:2409.18698](https://arxiv.org/abs/2409.18698) [astro-ph.CO].

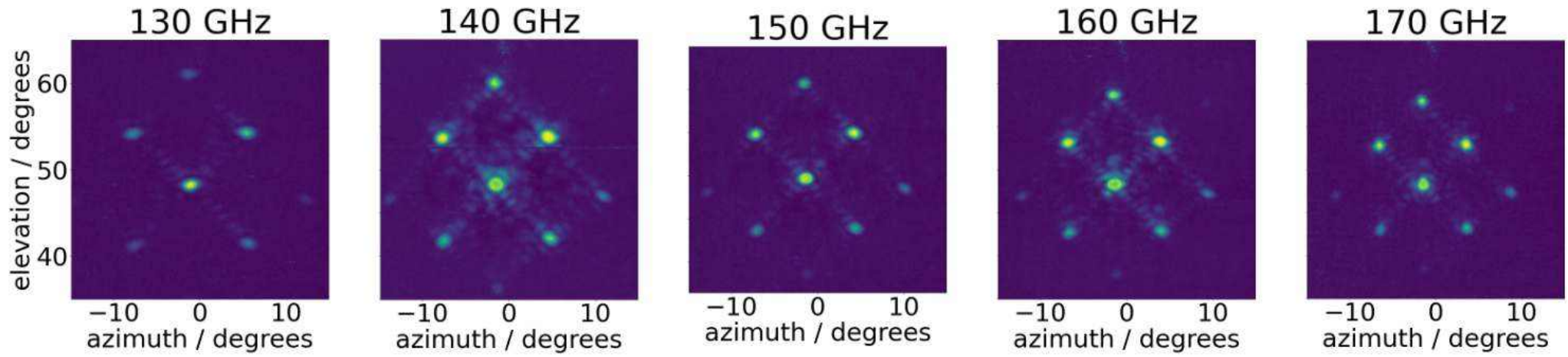


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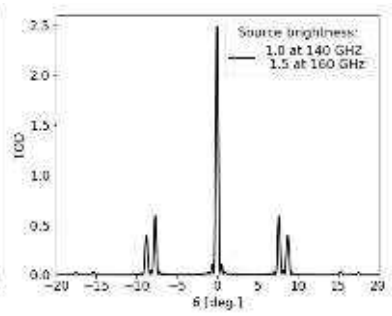
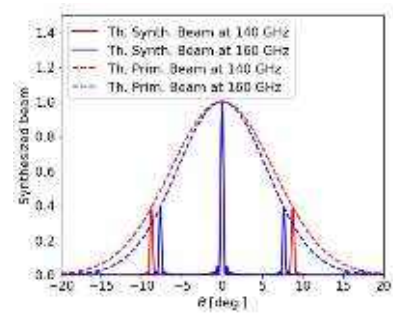
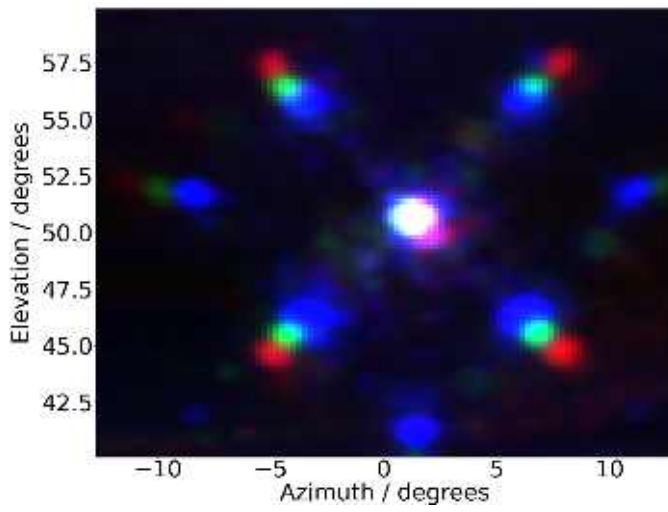
Technical Demonstrator: individual TES synthesized beam reconstruction (lab. measurements)

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 -25° to $+25^\circ$. Then increases the elevation and perform a new azimuth scan.
2. After scanning each TES produces a synthesized map (function of frequency)



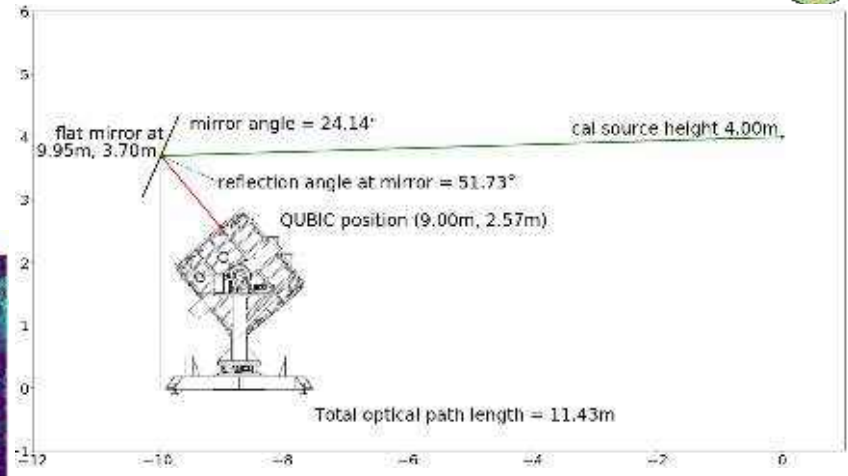
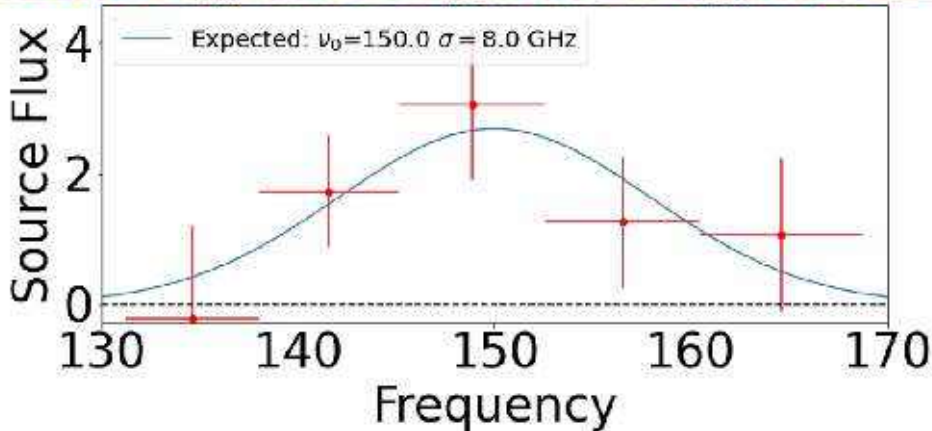
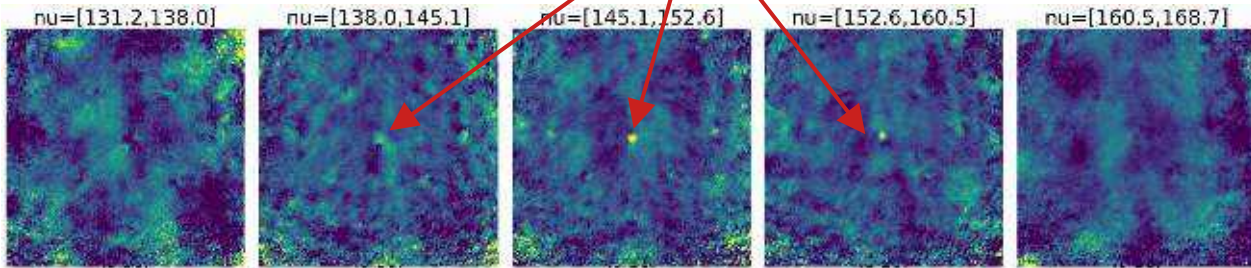
- JCAP04(2022) 034.
 - [arXiv:2409.18698](https://arxiv.org/abs/2409.18698) [astro-ph.CO].





Technical Demonstrator: sky-map reconstruction (lab. measurements)

Point source @ 150 GHz



- 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 Demonstrator: from laboratory to installation at site (~5000m above sea level)



2021



2022



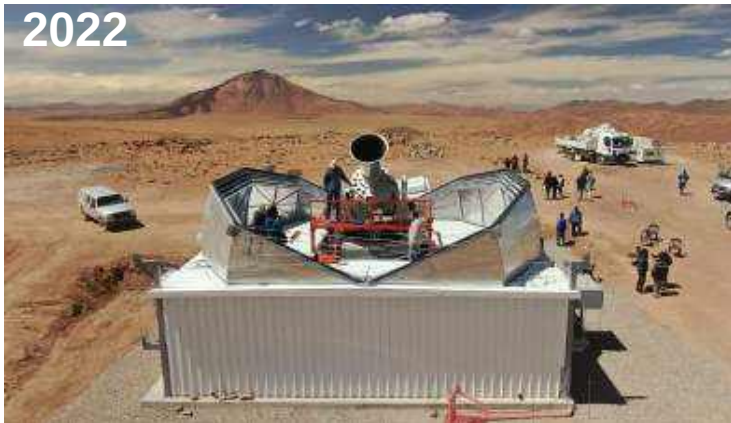
Inauguration Nov. 2022



2022



2022

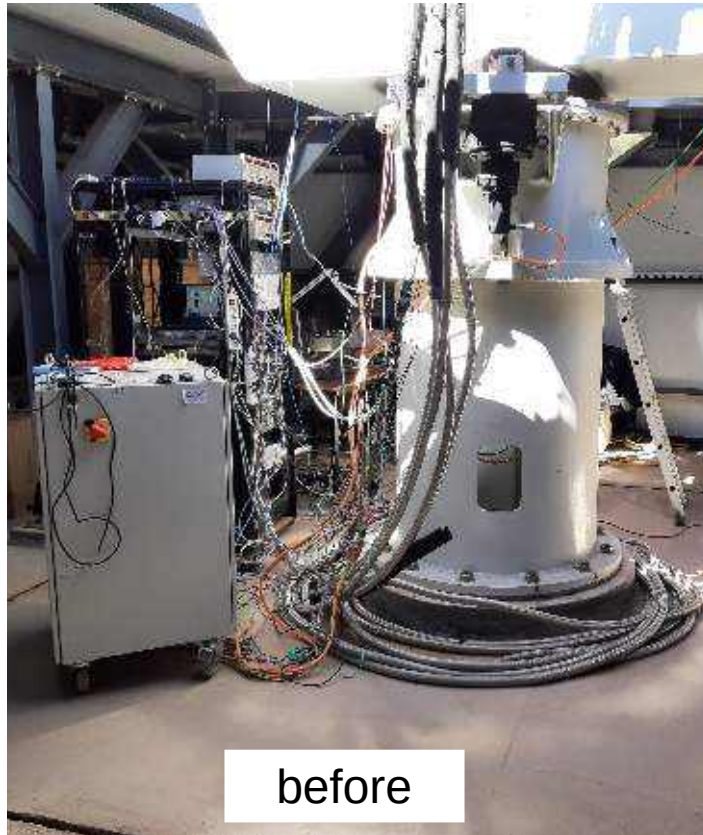


2024-2025
Calib. Tower
Mount upgrade for full azimuth scan





Installation of cable carrier Oct/Nov 2025



before



after





snowstorms hamper regular data taking (among other difficulties)



1 August 2025



8 August 2025



28 December 2025



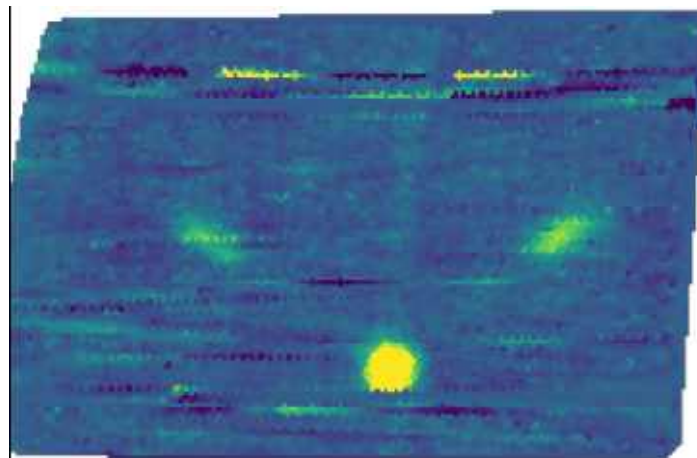


snowstorms hamper regular data taking (among other difficulties)





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



Much more to come in the following months!

Thank you

