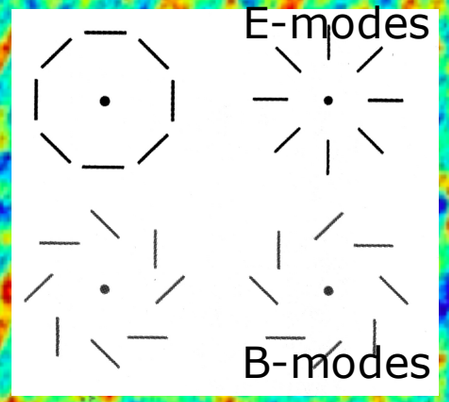
LSPE

F.Gatti

CdS, 16 Luglio 2020



Large Scale Polarization Explorer

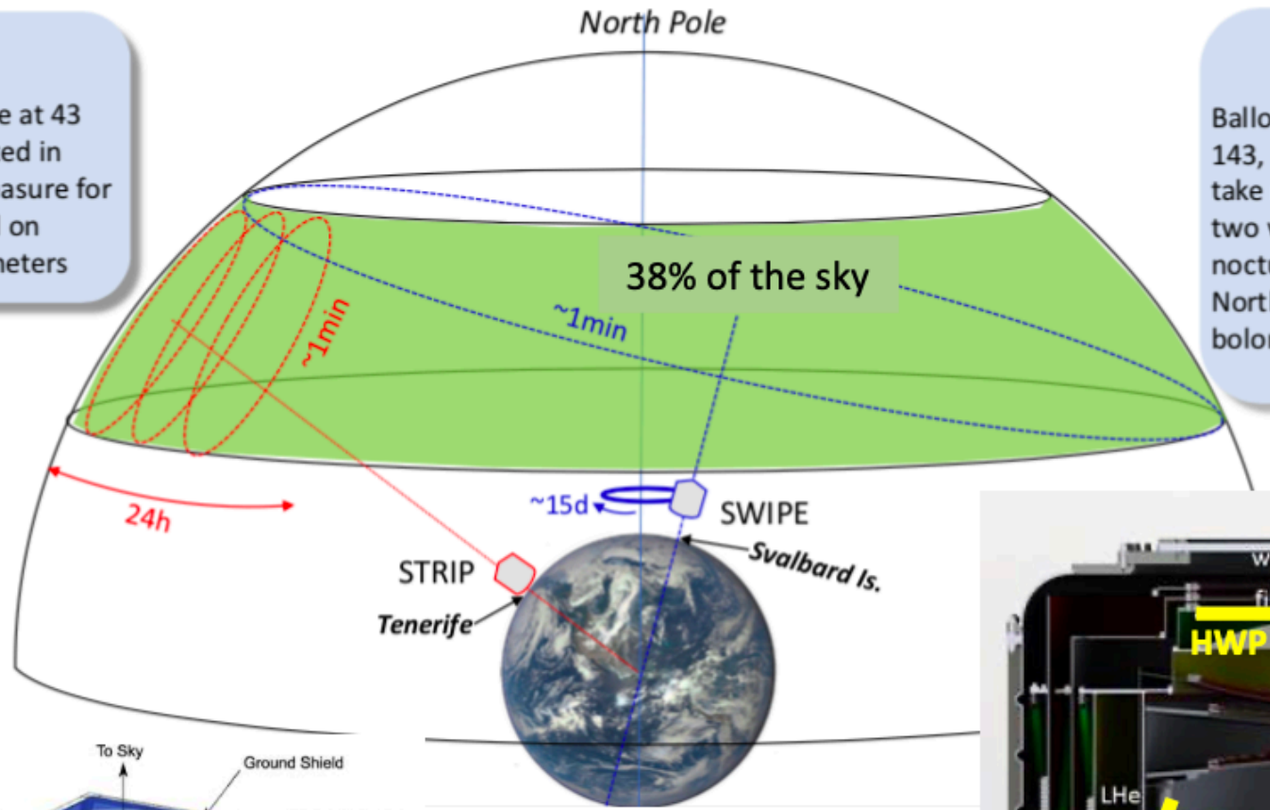
- **Target:**
  - **Accurate CMB polarization angles**
  - **Precise estimates of** τ and **r** ($\sim 10^{-2}$)
- **2 Istruments covering the same northern sky:**
  - STRIP: coherent, 43 +90GHz, 17% + 8% BW, 20’ + 10’ FWHM, 100 + 800 mK arcmin
  - SWIPE: multimode TES, 145+210+240 GHz, 30%+20%+10% BW, spin 85’ + 85’ + 85’ FWHM, 16 + 28 + 55 mK arcmin
  - Frequency coverage: 40 – 250 GHz (5 bands)
- **STRIP**: Commissioning in Tenerife for STRIP: end 2021
- **SWIPE:** Launch: provisional (but realistic including covid-19) 2022

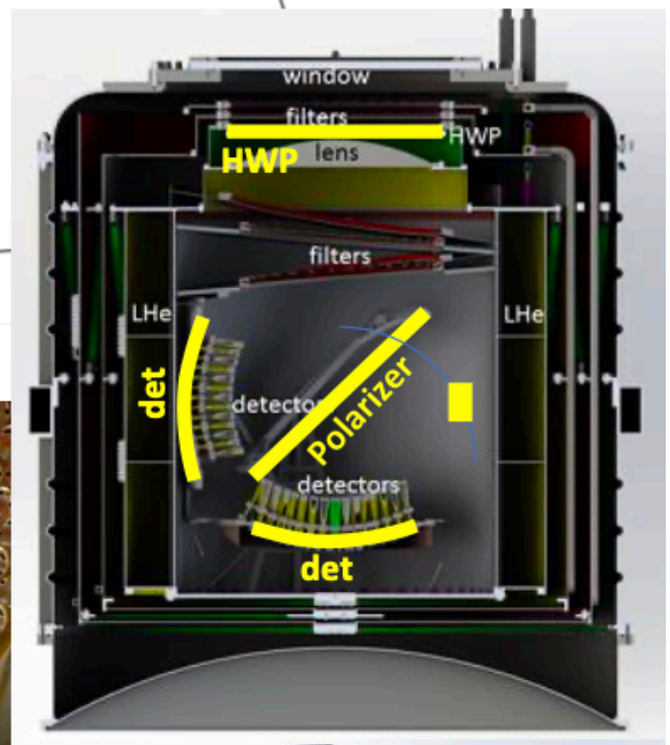
STRIP

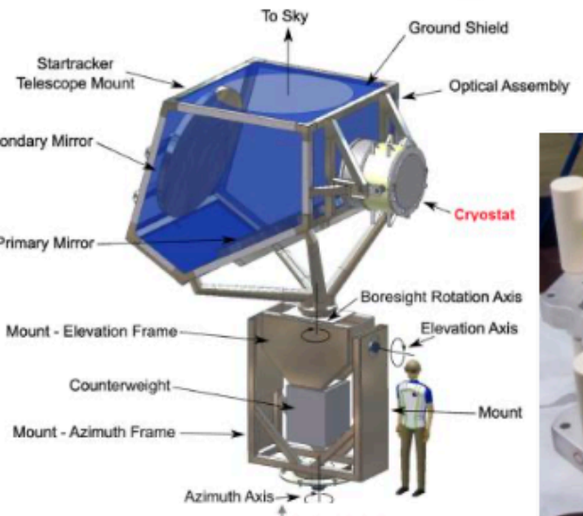
Ground telescope at 43 and 95 GHz located in Tenerife. Will measure for two years. Based on coherent polarimeters

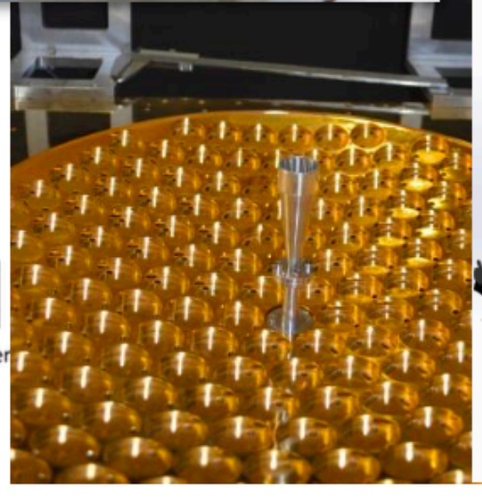
SWIPE

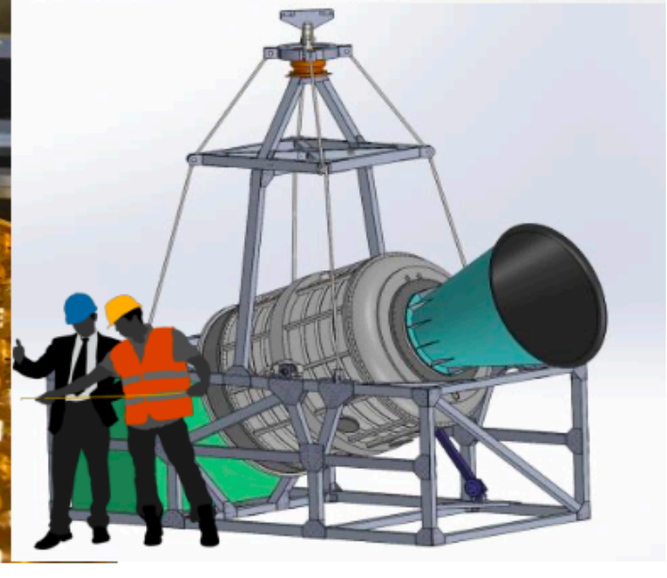
Balloon borne telescope at 143, 220 and 240 GHz. Will take measurements for two weeks during a LDB nocturnal flight around the North Pole. Based on TES bolometers

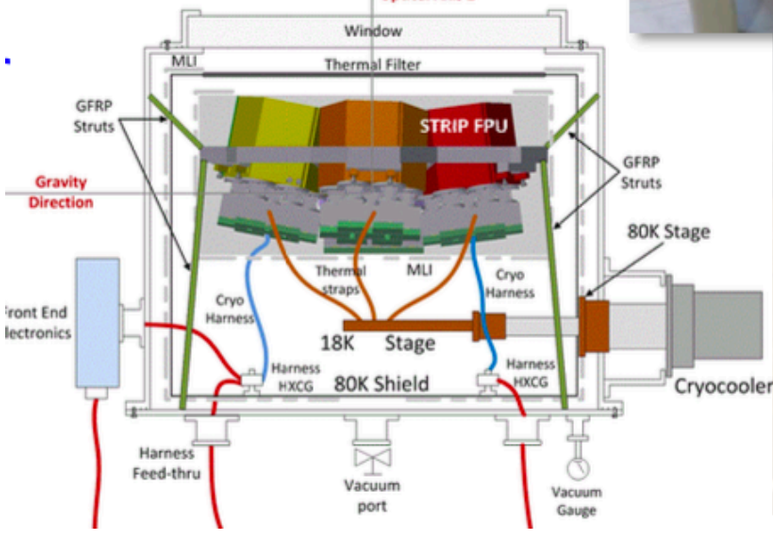




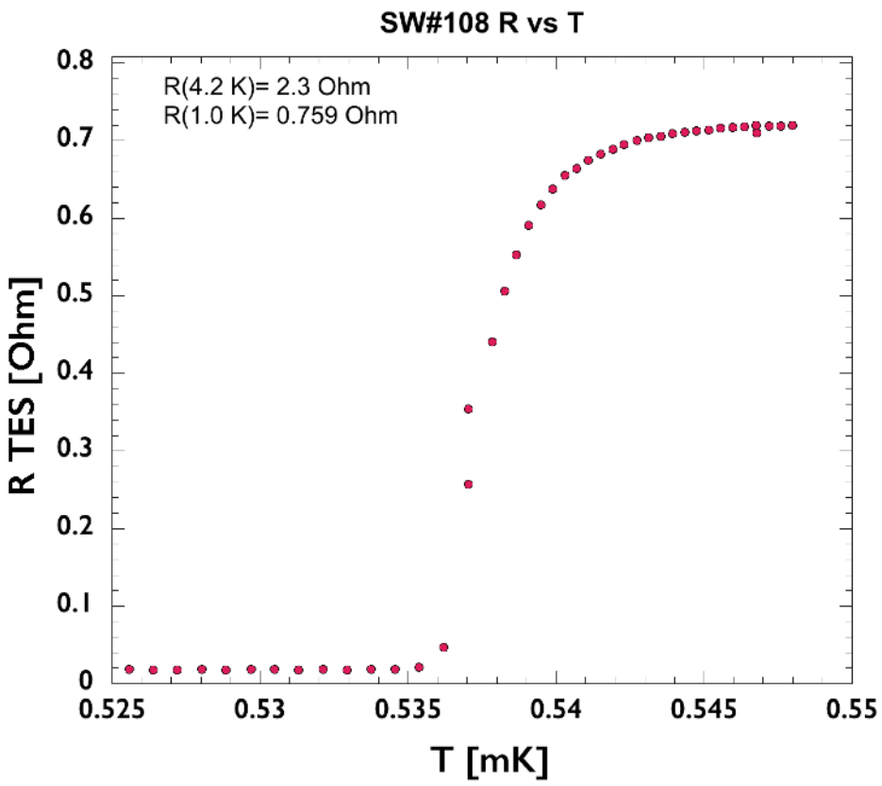


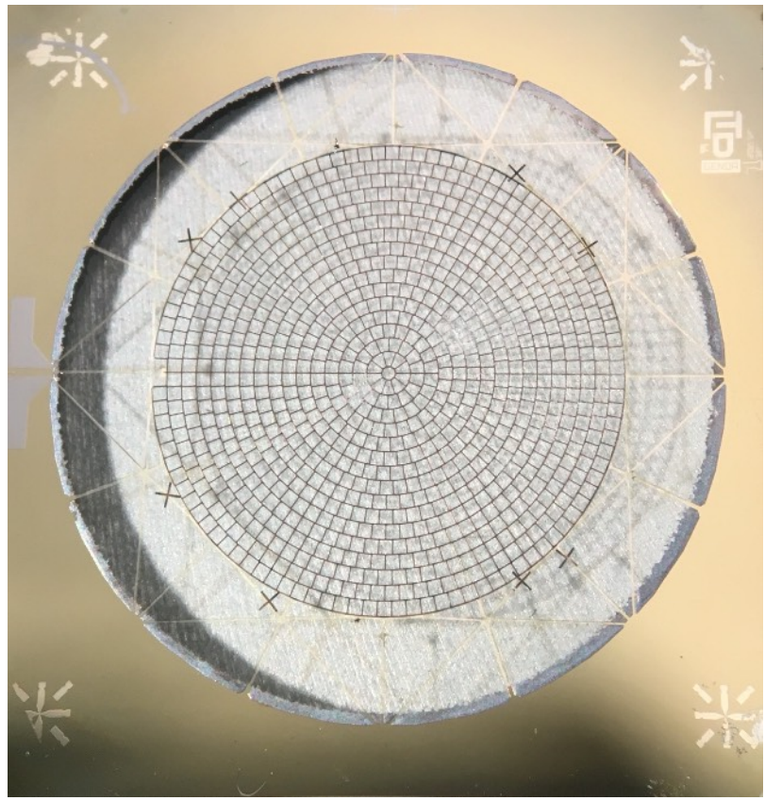


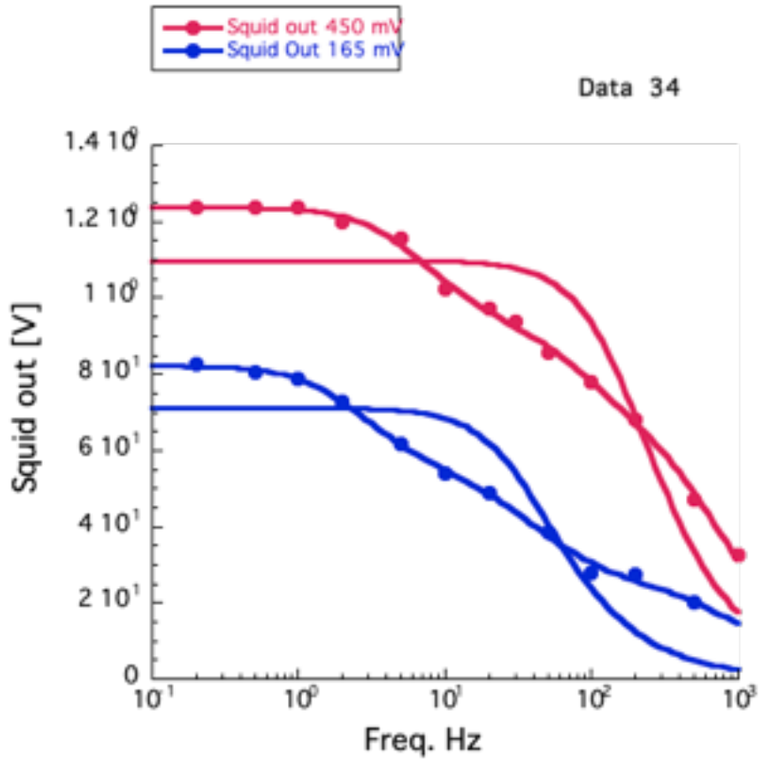




330 bolometri





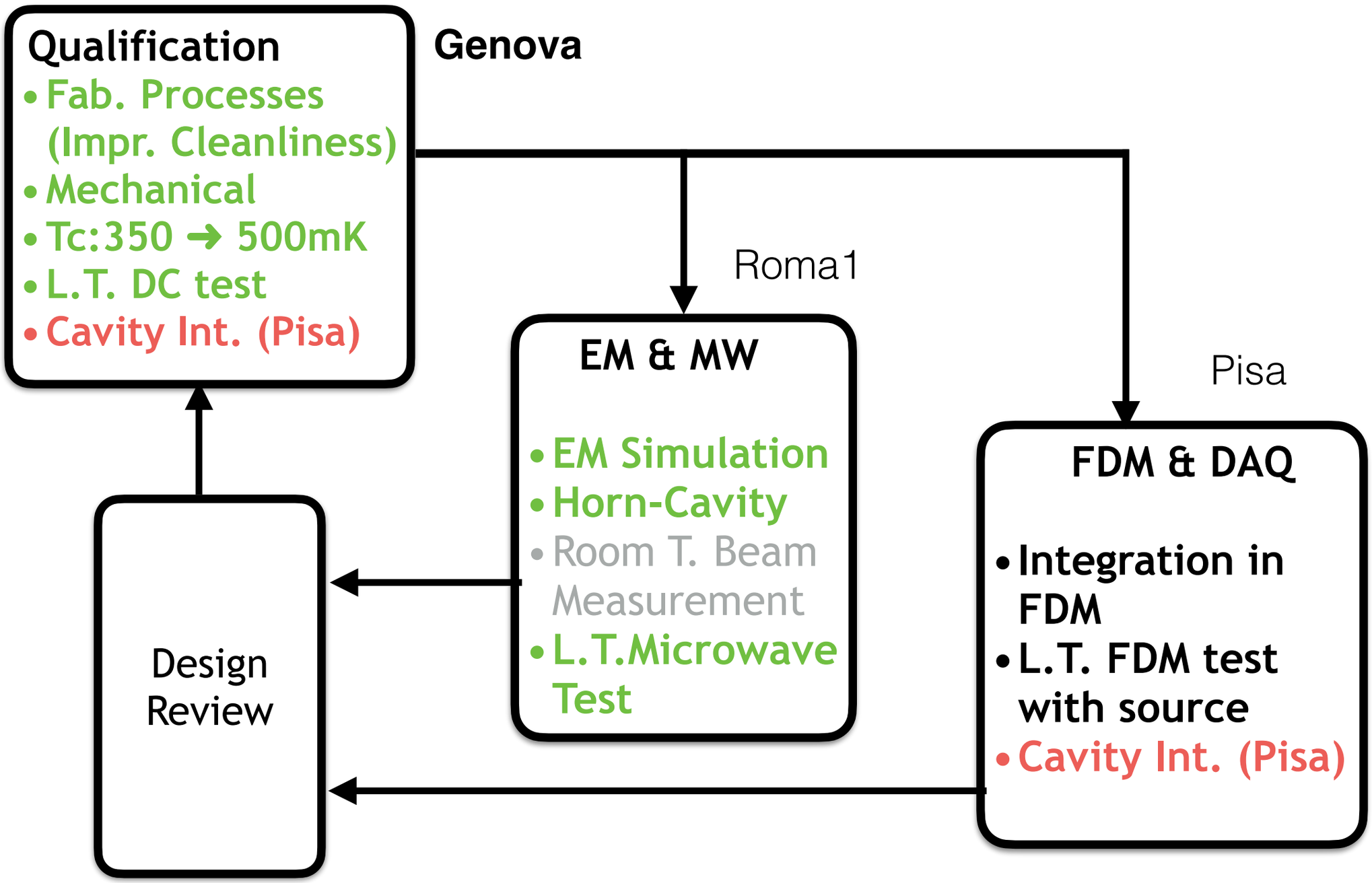


Tc= 530-550 mK

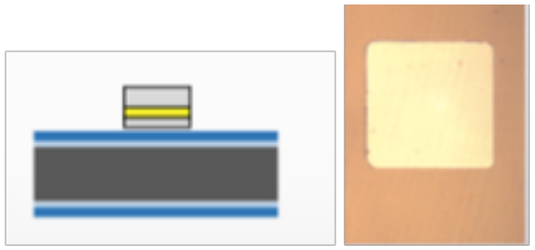
Tbase=350 mK

T1=30ms, T2=2 ms

BOLOMETER PROCESS FLOW



Qualification of Bolometer Fab Process (1)



4 x chips → 2 x 3” wafers

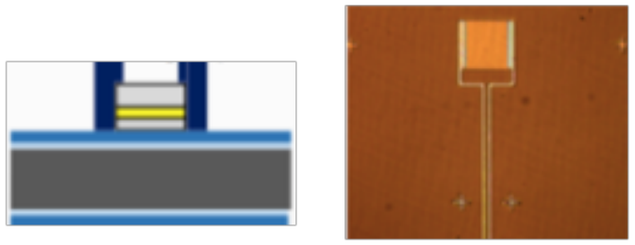
Wafer cleaning 15’

TES Litho N 25’

TES deposition 30’

TES lift-off 15’

< 1 h 25 m



4 chips → 2 x 3” wafers

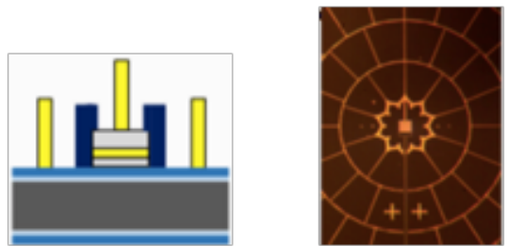
TopSide Clean. 5’

Wires Litho N 30’

Wires deposition 30’

TES lift-off 15’

< 1 h 20 m



4 chips → 2 x 3” wafers

TopSide Clean. 5’

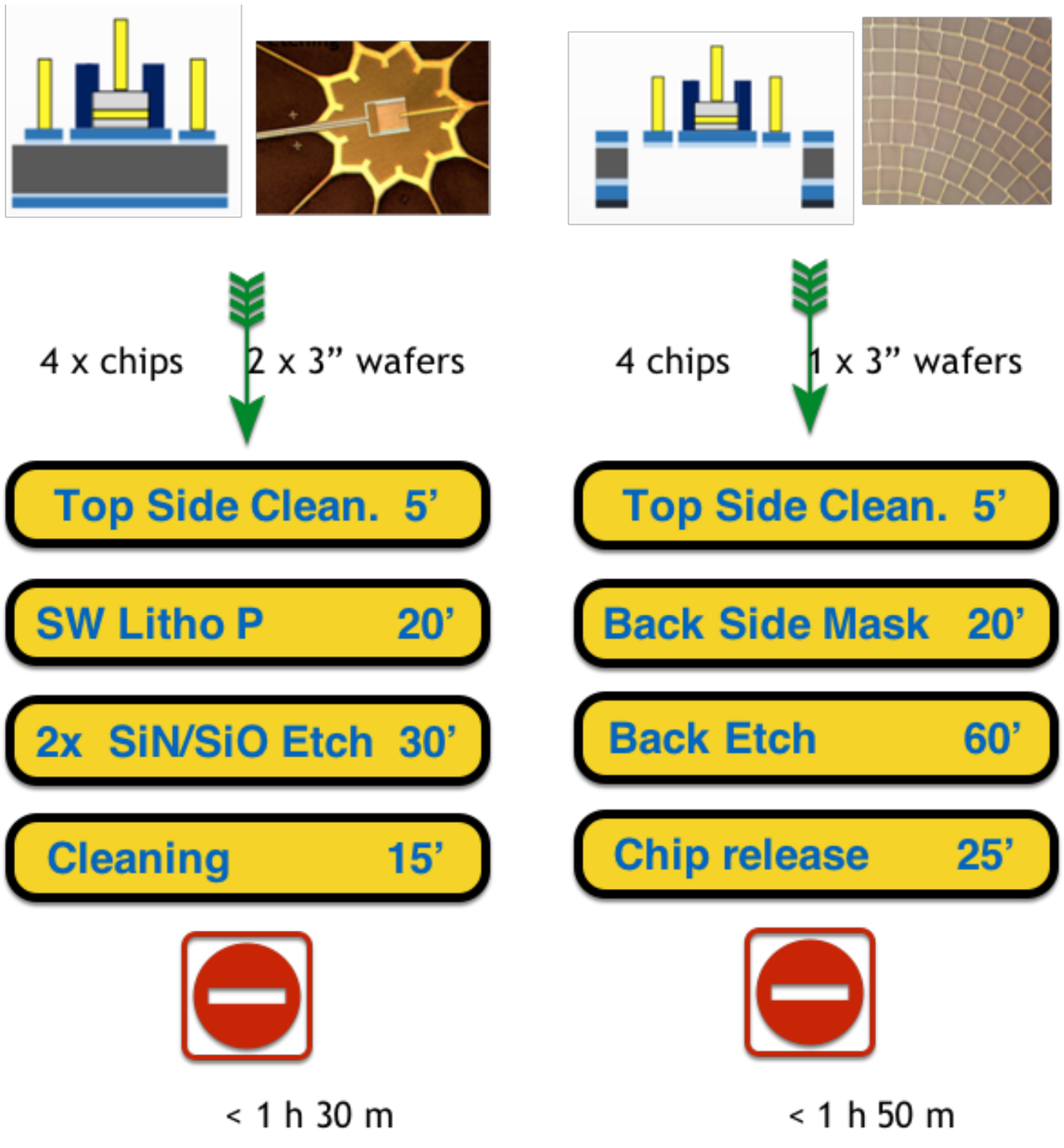
Abs. Litho N 20’

Abs. deposition 30’

Abs. lift-off 15’

< 1 h 10 m

Qualification of Bolometer Fab Process (2)

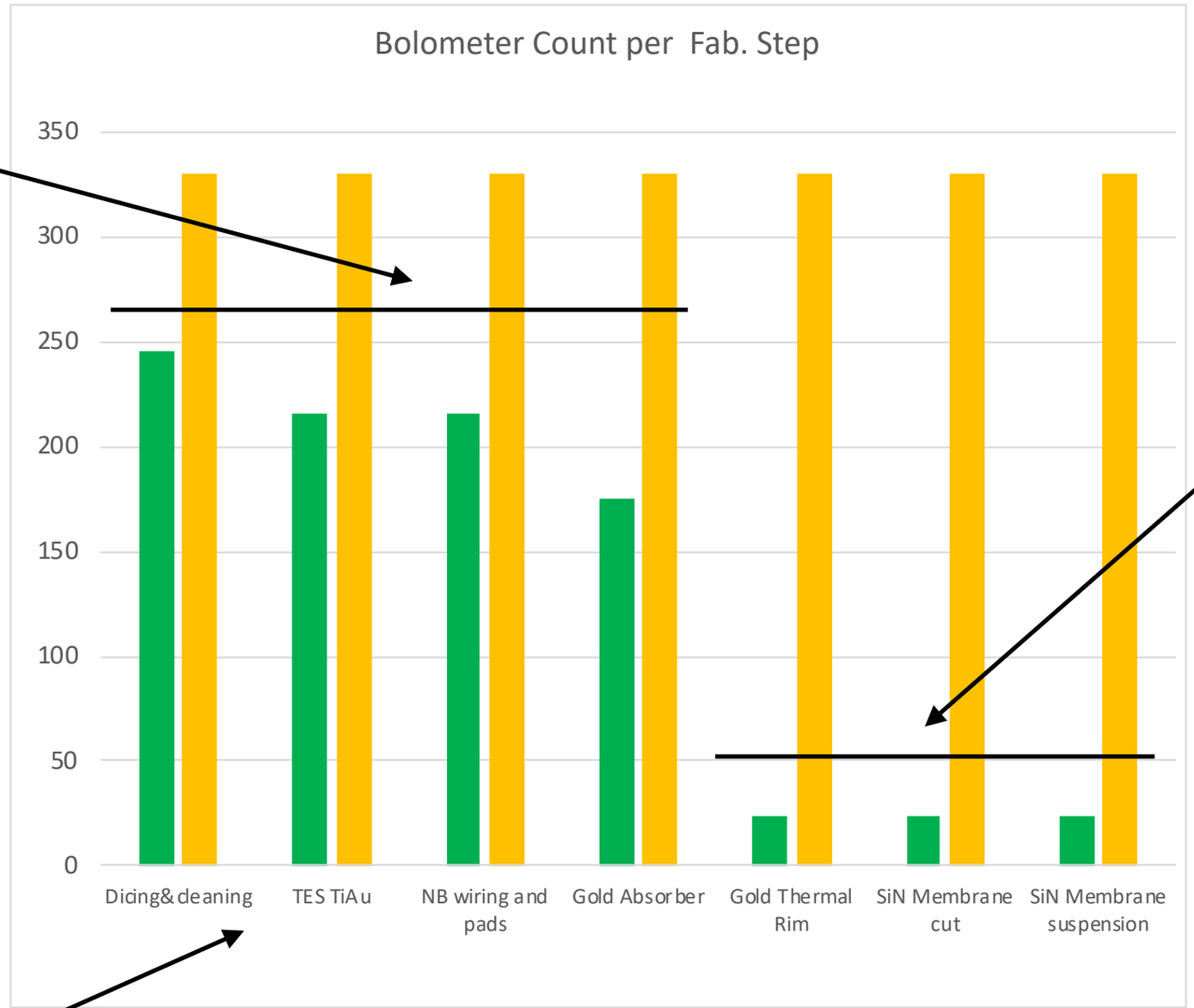


Shift Personnel

B. Siri (coord.)
A. Bevilacqua
L. Parodi
F. Siccardi
M. Rigano
F. Gatti
L. Ferrari Barusso

Fabrication Status (oct.-dec 19)

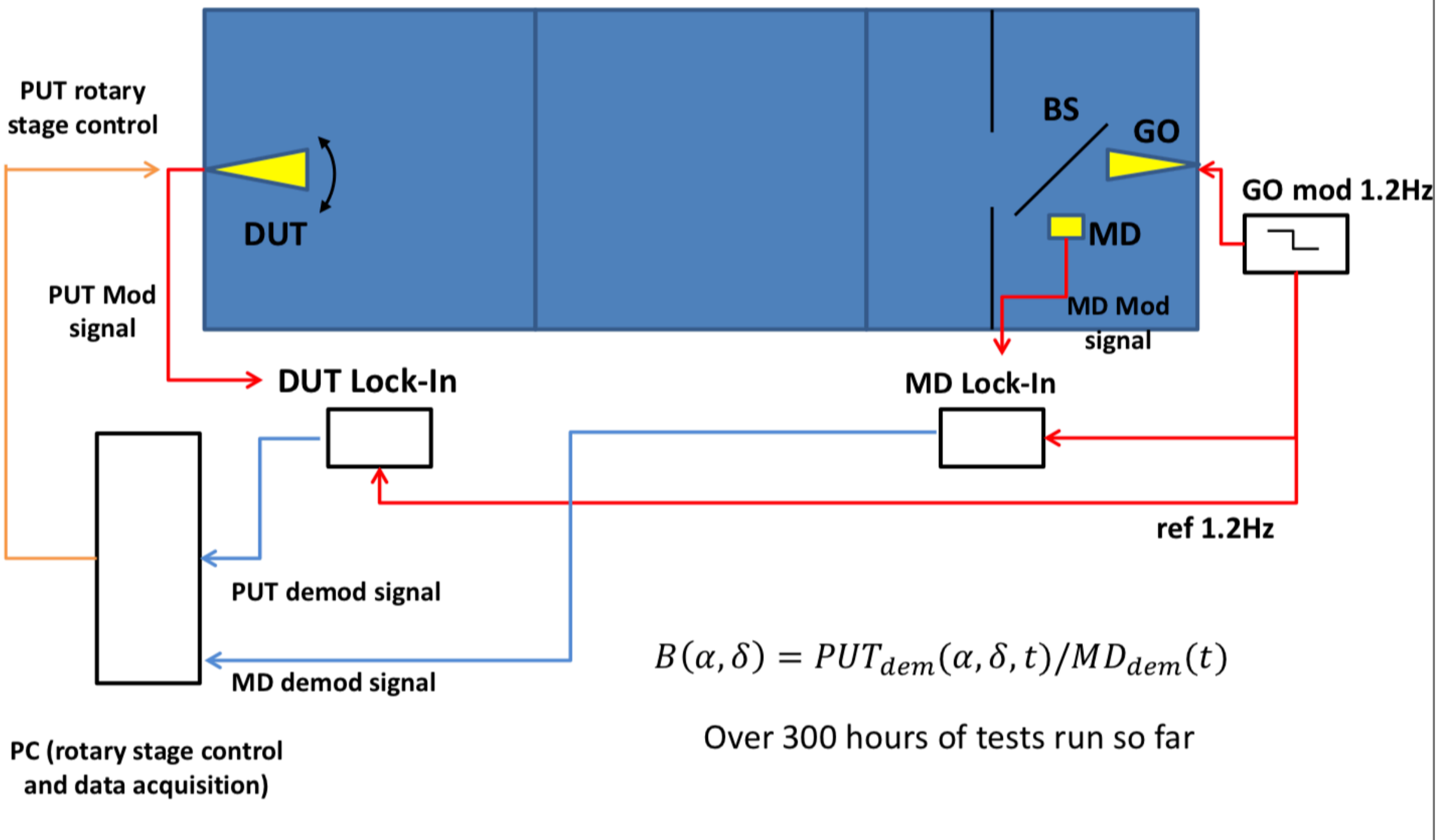
Completion as soon we can work with shfit with group of 3 people



wait for Roma1 test for tuning thermal conductance

Now under Test for Tc measurements

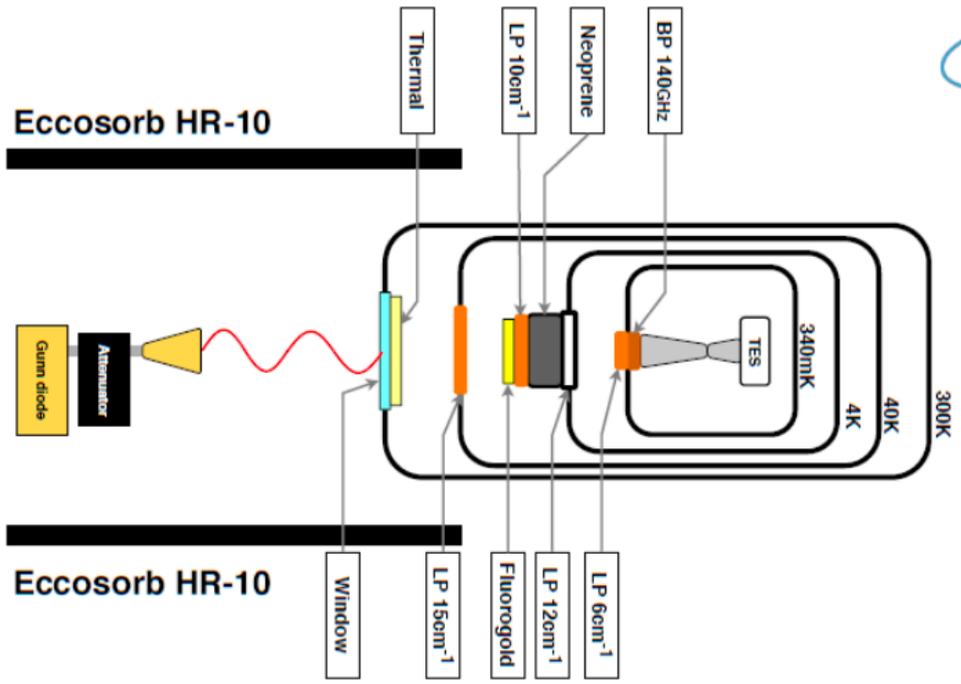
Tests of the pixel assembly

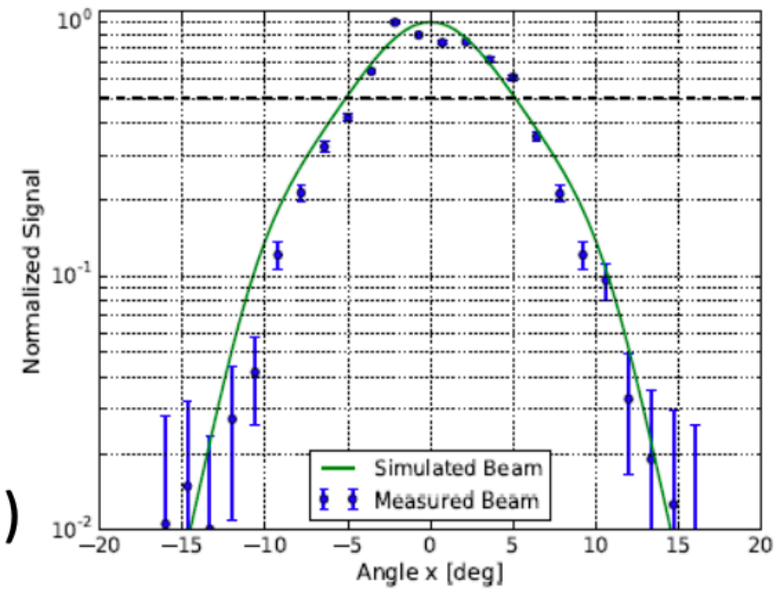


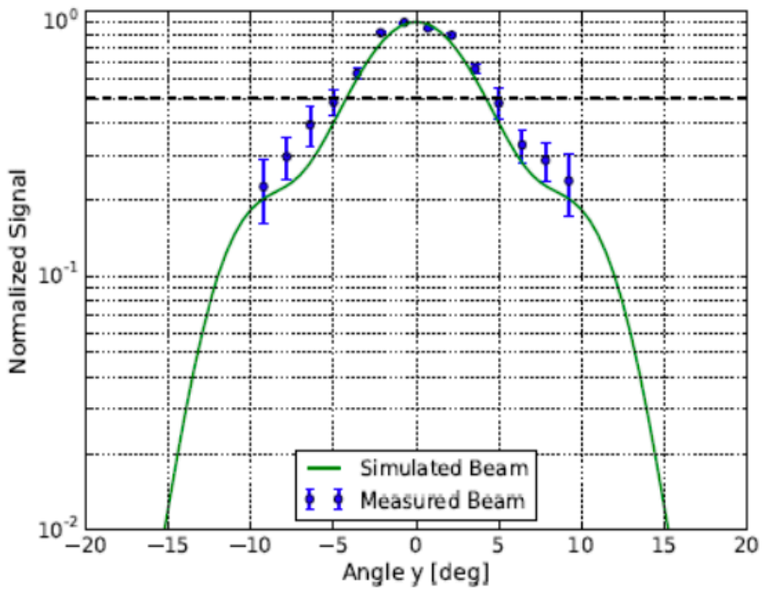
$$B(\alpha,\delta) = PUT_{dem}(\alpha,\delta,t)/MD_{dem}(t)$$

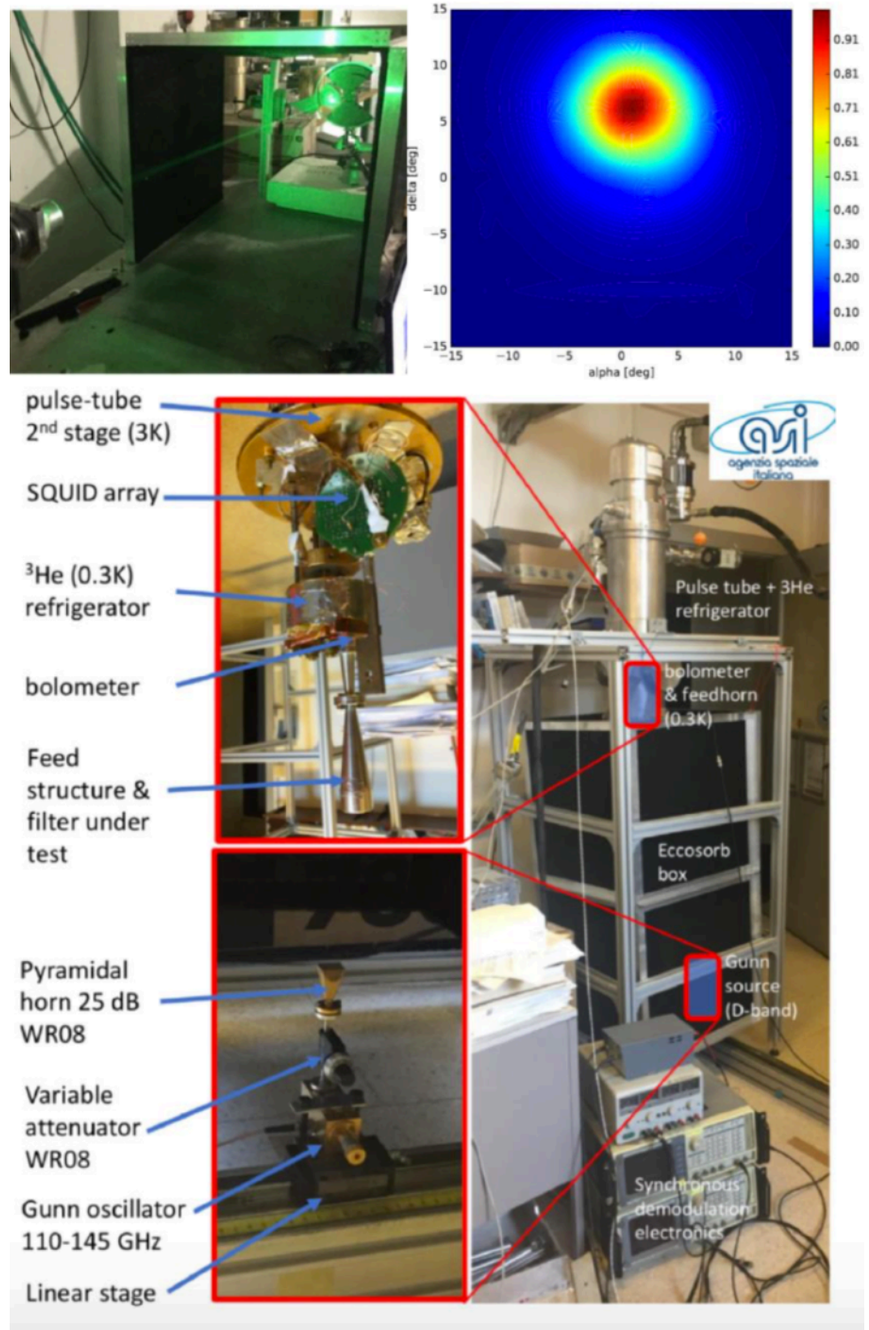
Over 300 hours of tests run so far

Bolometer microwave tests presently almost within the expectations, final tuning of G needed.

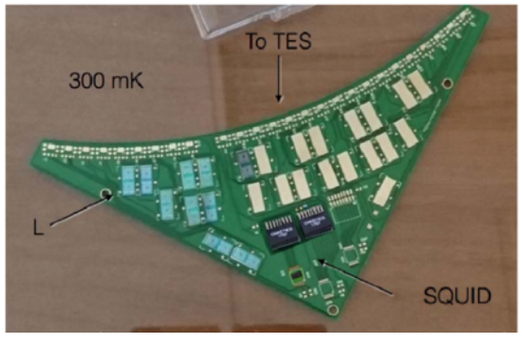


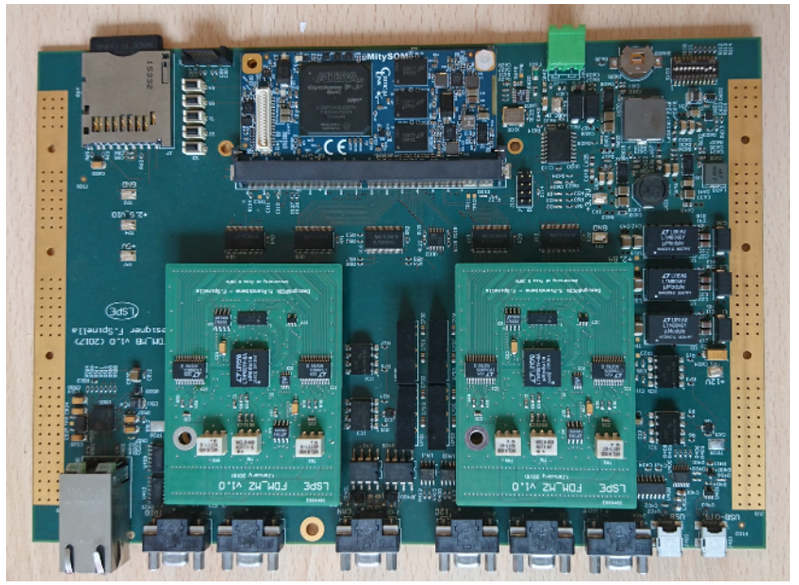


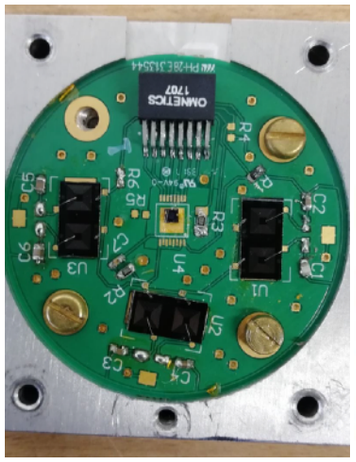




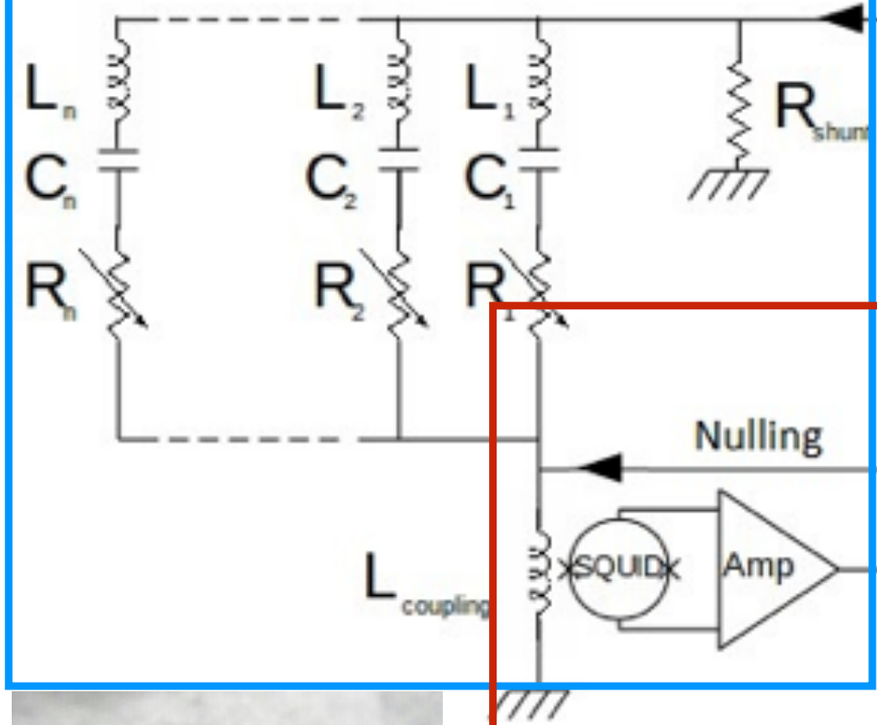
Full readout



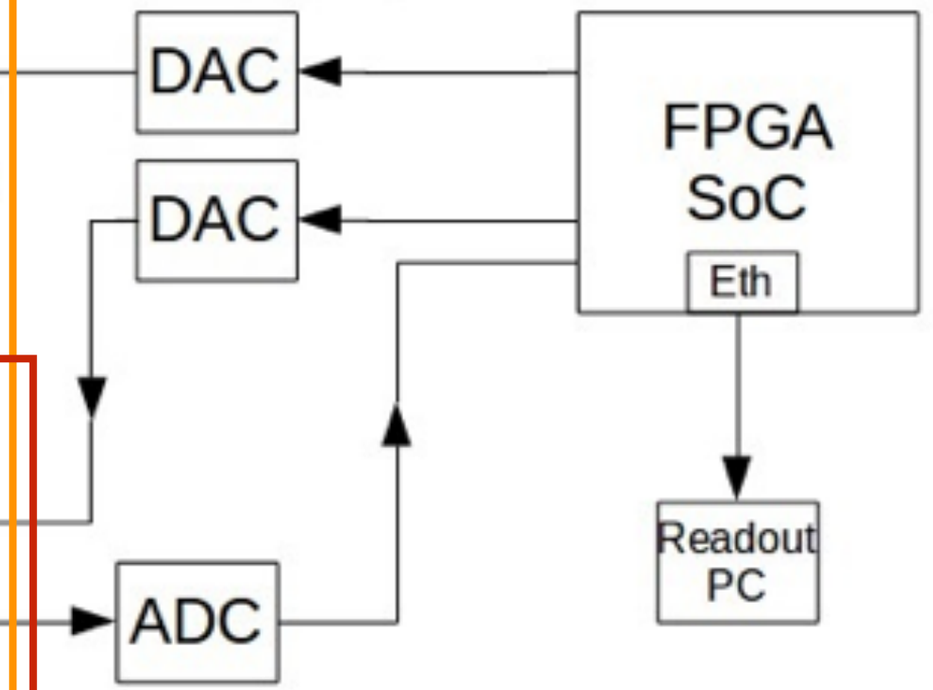


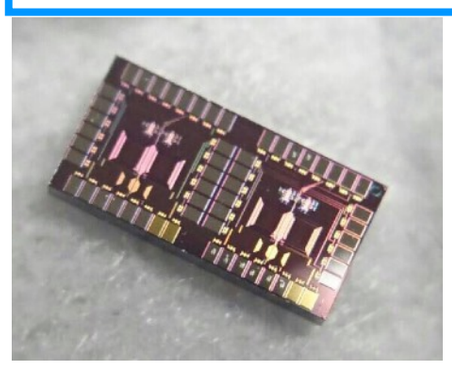


0.3 K-Pisa

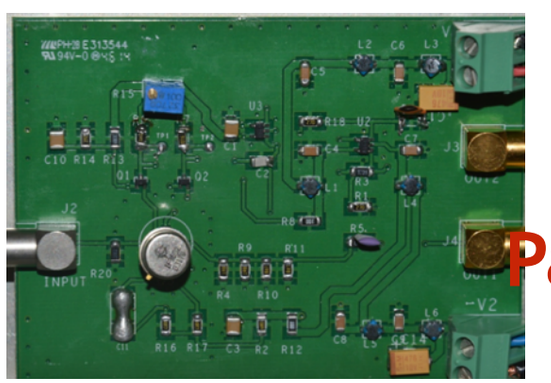


220K-Pisa/Ferrara





0.3/220K
Genova/Pisa

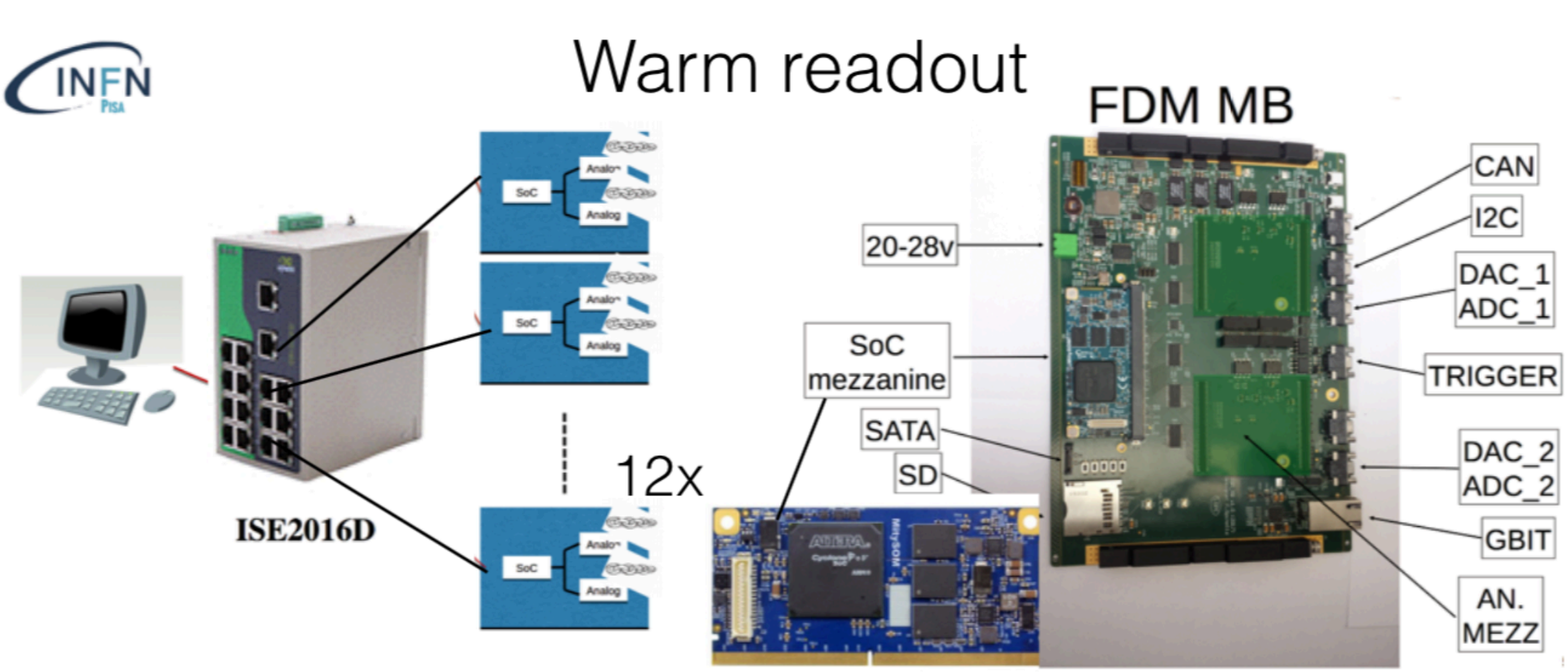


Componentistica pronta
Partenza produzione

Conclusioni LSPE Genova

- Bolometri rispondono ai requirement di NEP< photon noise—-> (NEP q.che 10^{-7})
- Risolto il “mistero” del beam spot: limiti del test seut-up di Roma1 (effetti delle finestre e diametro delle stesse).
- Auspicabile un aggiustamento della costante tempo (in corso).
- Processo di produzione: + 200 bolometri pronti per il “taglio della membrana”
- SQUID chip: wafer da VTT con chip non testati in corso di qualifica (20 x esperimento + altri per test)
- Elettronica per SQUID FLL: BW=2MHz
- Obiettivo: finire fabbricazione (2020), inegrare e completare completare l’apparato(2021).

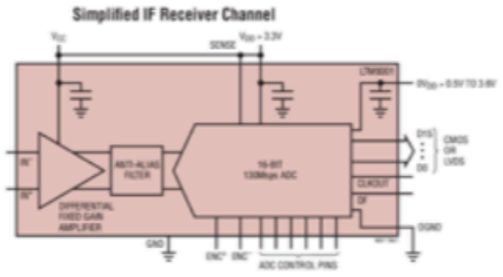
LSPE-SWIPE: PISA

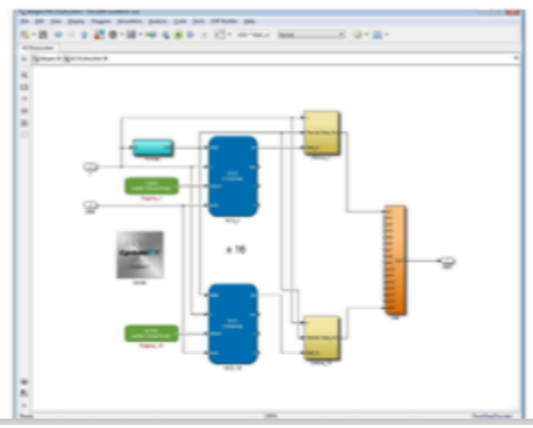


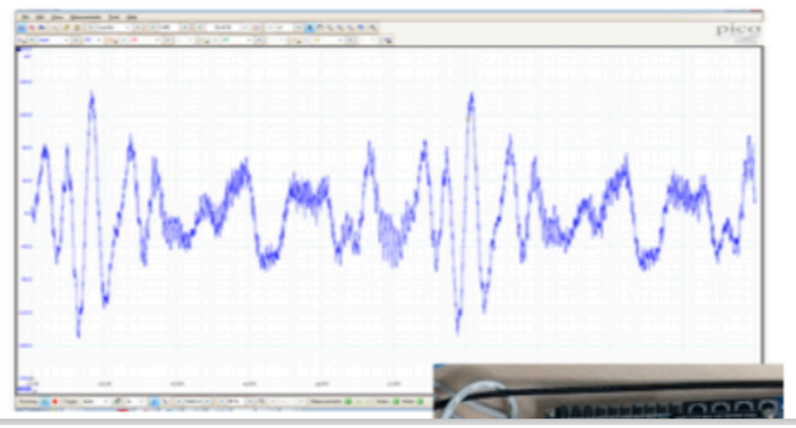
- Board V0 - containing all possible interfaces - designed, produced and under test
- Preliminary firmware for the tone generation tested
- Backbone of complete firmware presently being written

NEW

- (ADC LTM9001GA, DAC LTC1668)



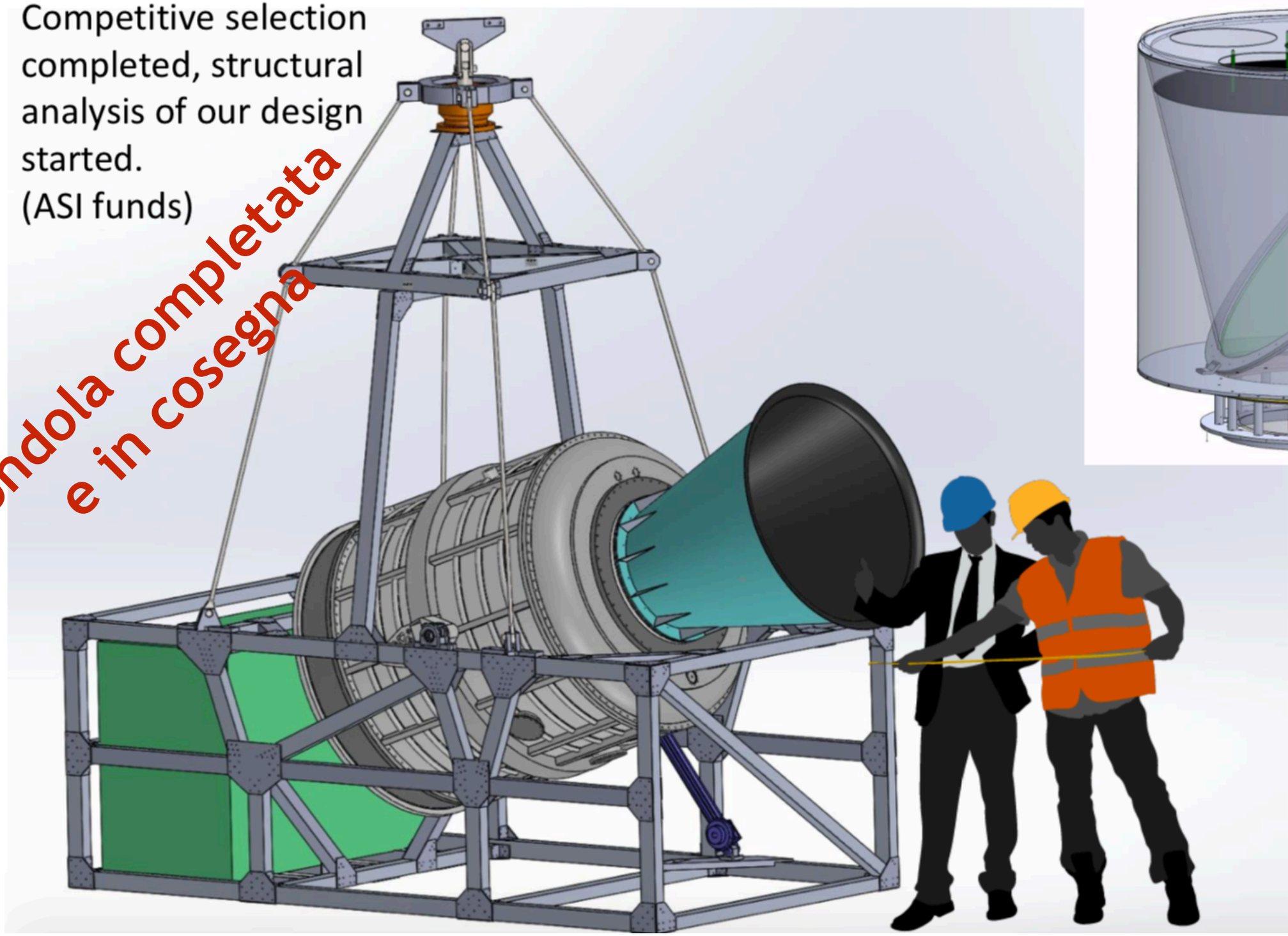




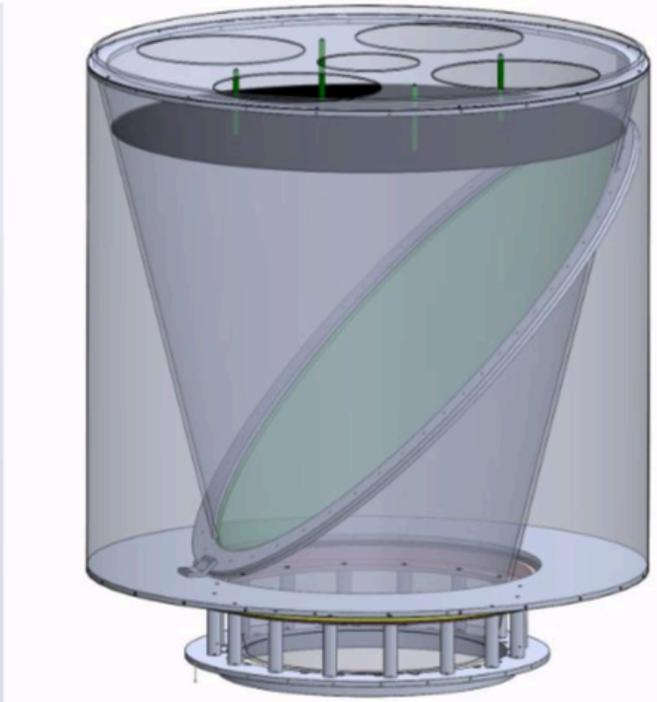
LSPE-SWIPE: ROMA1

Payload gondola
Competitive selection completed, structural analysis of our design started.
(ASI funds)

Gondola completata e in consegna

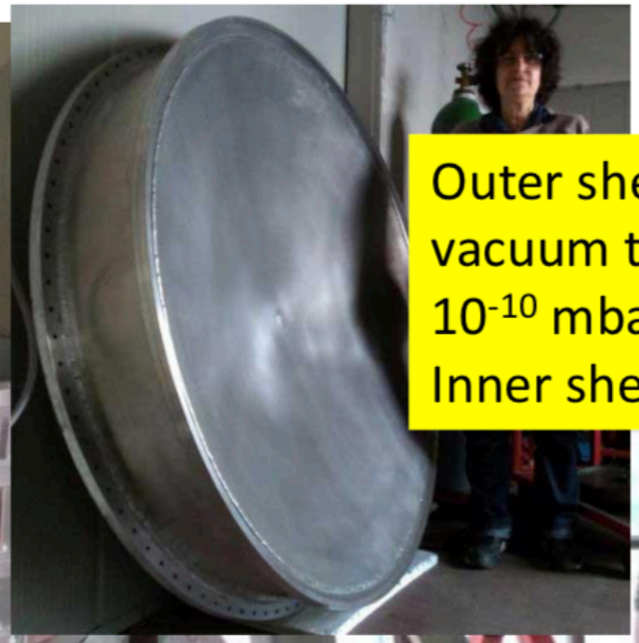


Full-beam polarized calibrator (ASI funds)



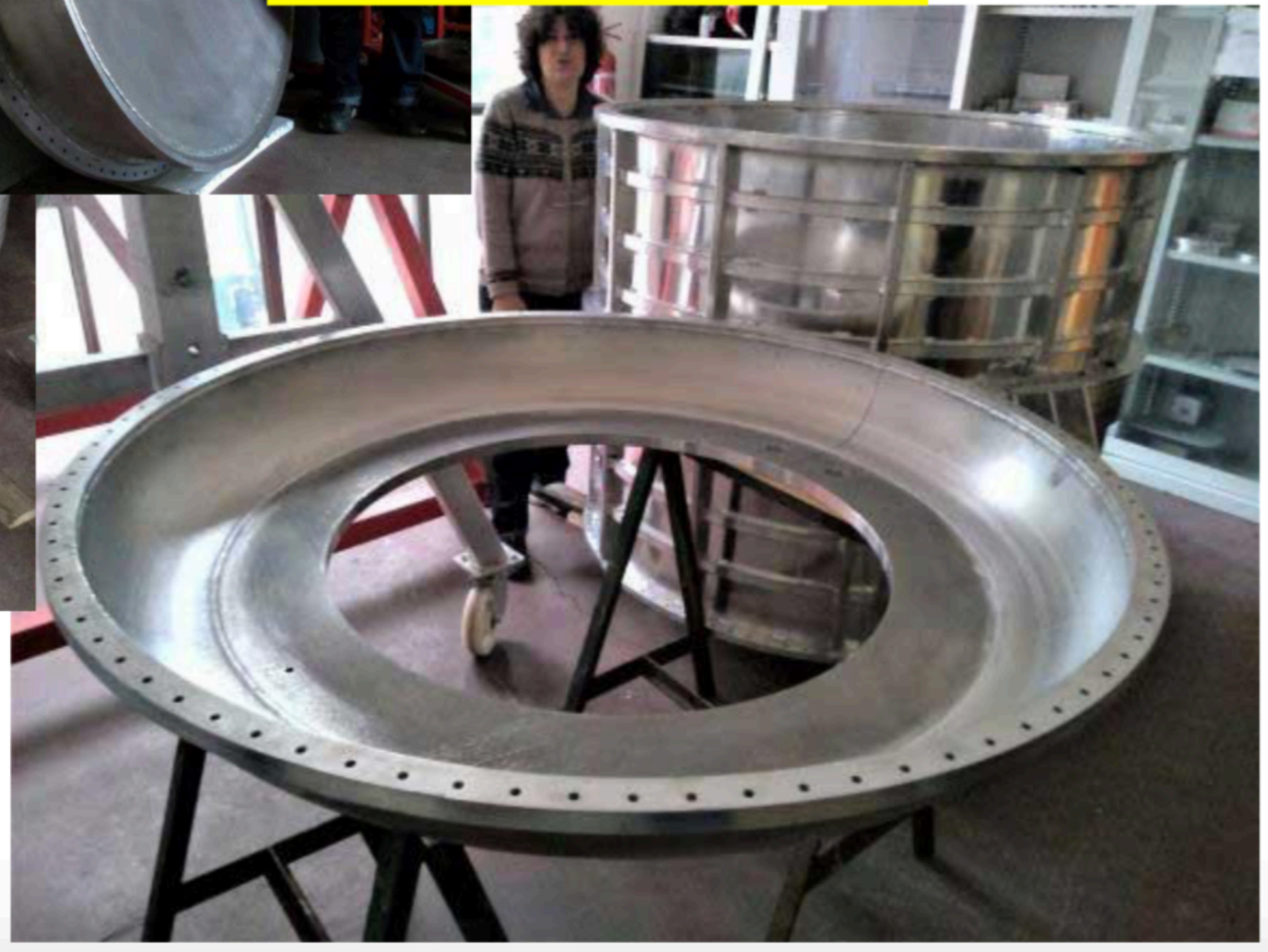
LSPE-SWIPE/STRIP: ROMA1

Main Cryogenic System



Outer shell assembled and vacuum tested to 10^{-10} mbar l s
Inner shell being welded.

Quasi Completo (schermi u-metal)



LSPE-STRIP: MILANO

LSPE/STRIP status

Selected site: Teide Observatory, Tenerife

- Low atmospheric contamination
- Ensure nearly same sky coverage as for SWIPE (85% overlap)
- Site preparation: agreement with IAC ongoing
- Excellent science synergy opportunity with QUIJOTE and GroundBIRD

- Genova: ordine per il basamento del telescopio sul Monte Teide - gara IAC e assegnazione a impresa locale, in costruzione insieme alla struttura di riparo.

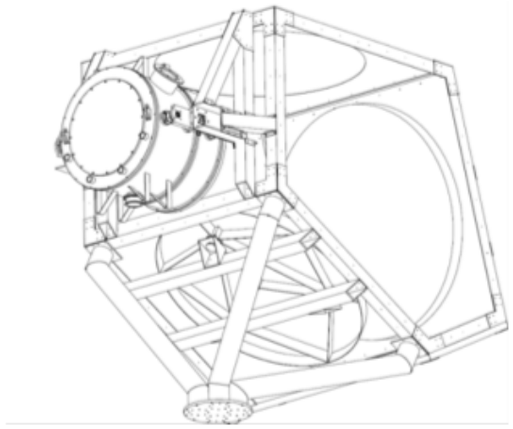
LSPE-STRIP: MILANO

In fase avanzata di disegno e simulazione

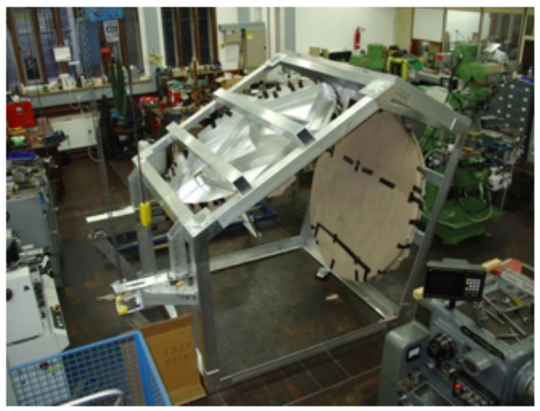
STRIP telescope and mount

Oxford-provided H/W requires significant modifications

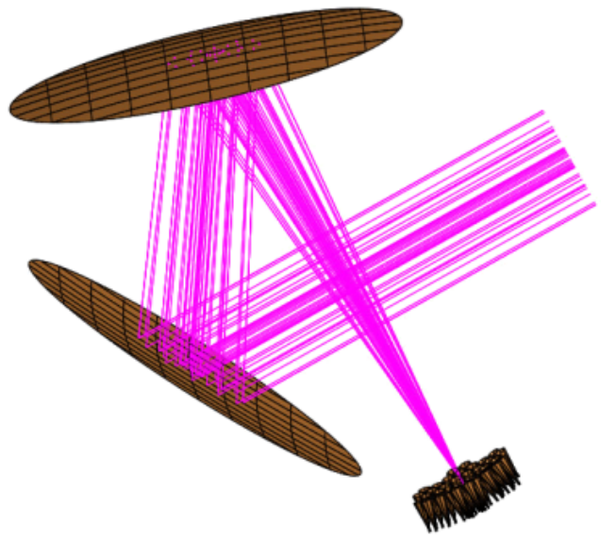
1) Instrument interfaces to optical enclosure to be adapted to STRIP instrument



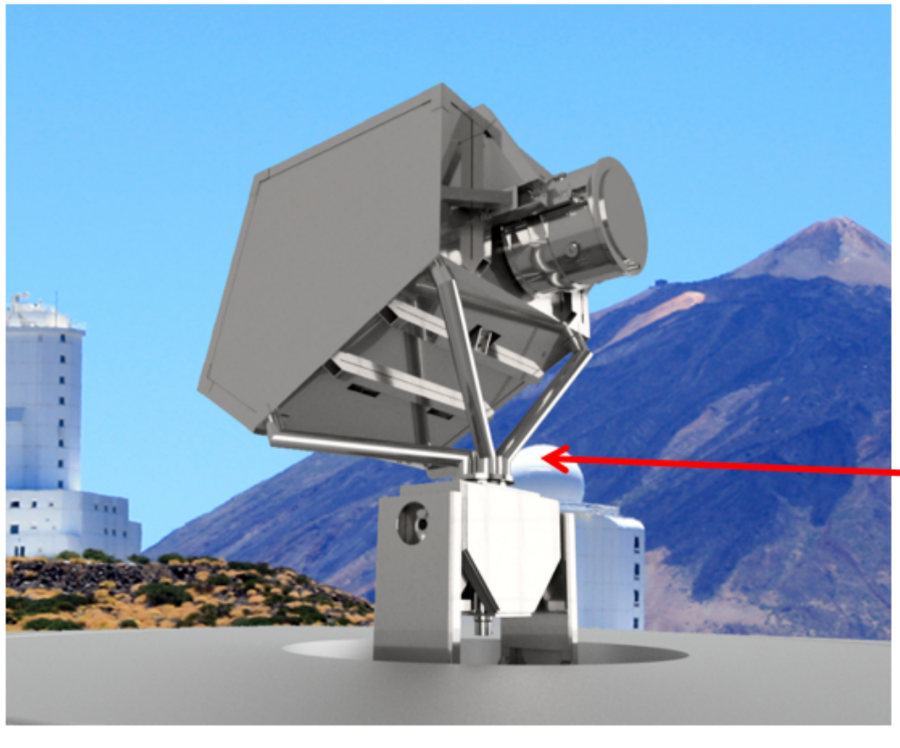
Full CAD model of STRIP mount and interfaces (INFN Rome)



Telescope at Oxford

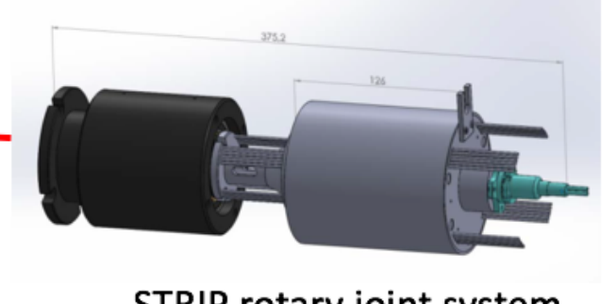


1.5m Cross-Dragone optics



2) New motors need to be acquired

3) Enable continuous rotation in scanning strategy (needed for large scale observations)



STRIP rotary joint system

4) Star tracker to develop mount/pointing model

Anagrafica e Richieste alla Sezione

Ric.	%
Gatti F.	60
Siri B.	90
Fontanelli F.	30
Celasco E.	50
Buatier F.	50
Totale	280

Servizio	MU
Progettazione	2
Meccanica	4
Criogenia	2

Coll. Tecnici	MU	
Luigi Parodi	12	Criogenia/vuoto/ Litografia
Fabio Siccardi	3	Elettronica
Adriano Bevilacqua	3	Litografia/ Apparati CR