Update of PHased Arrays for Reflector Observing Systems

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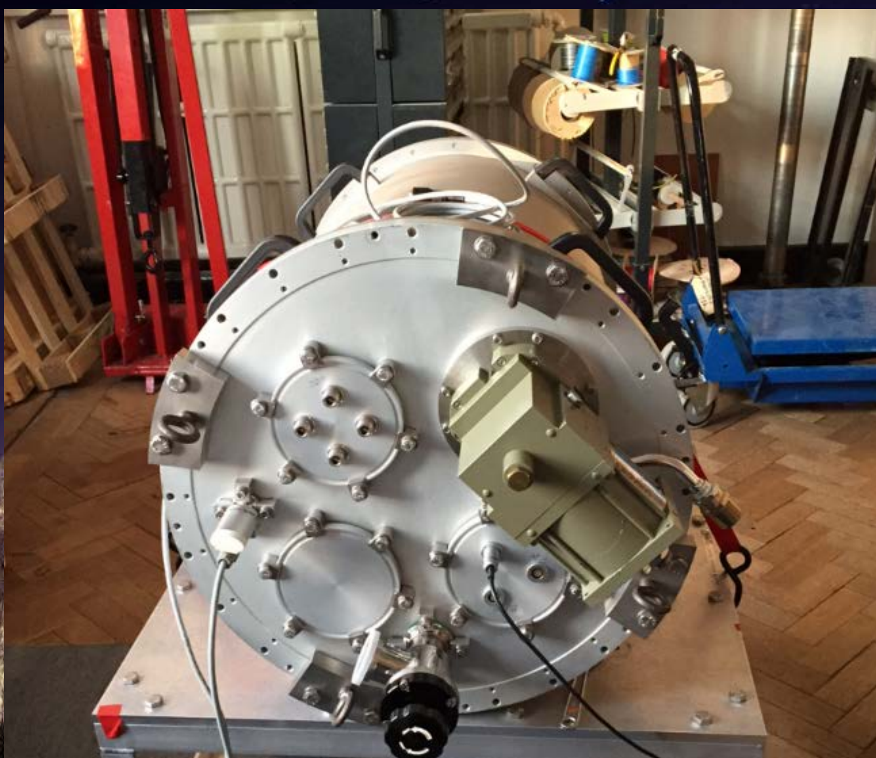
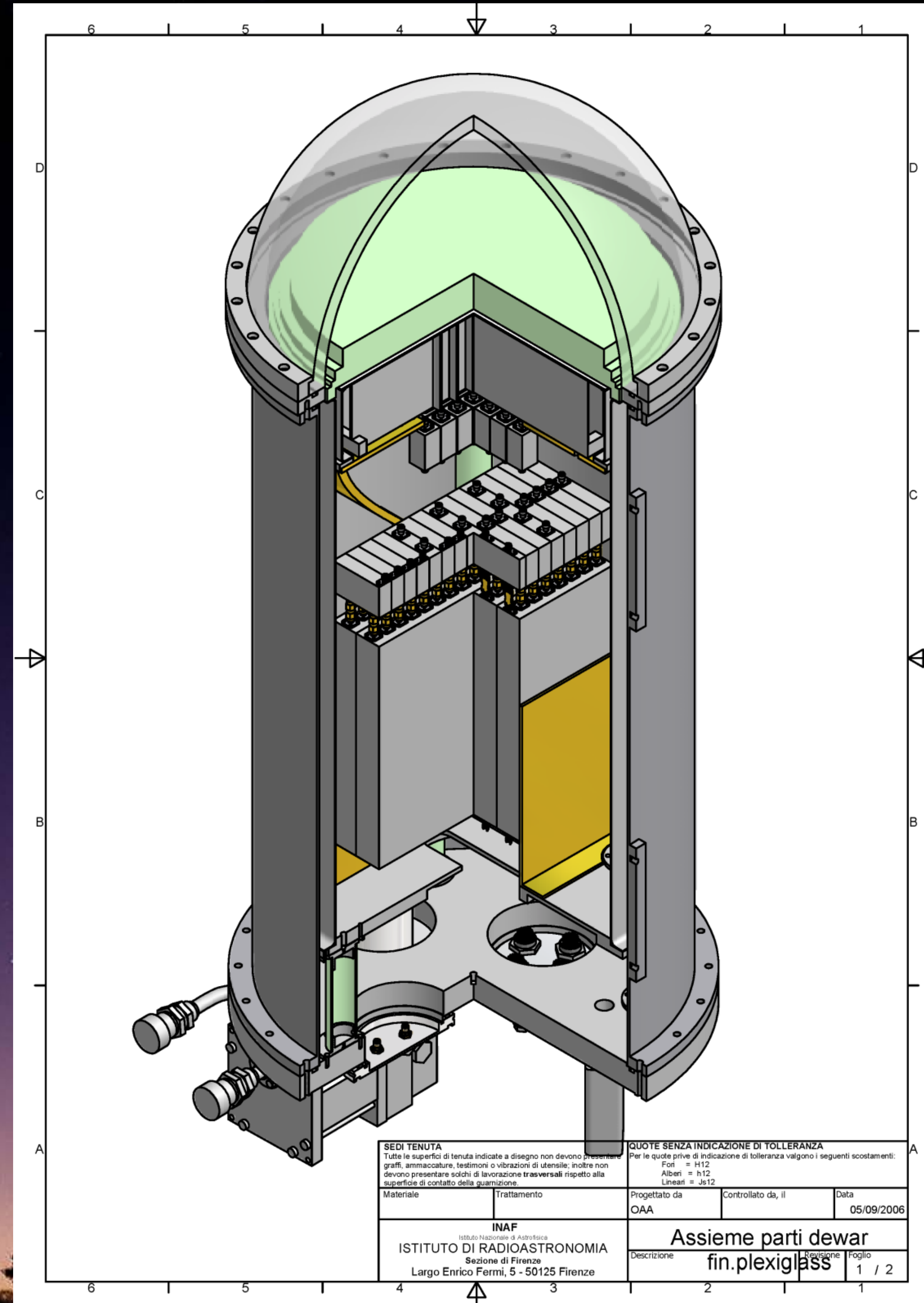
The University of Manchester

PHased Arrays for Reflector Observing Systems (PHAROS)

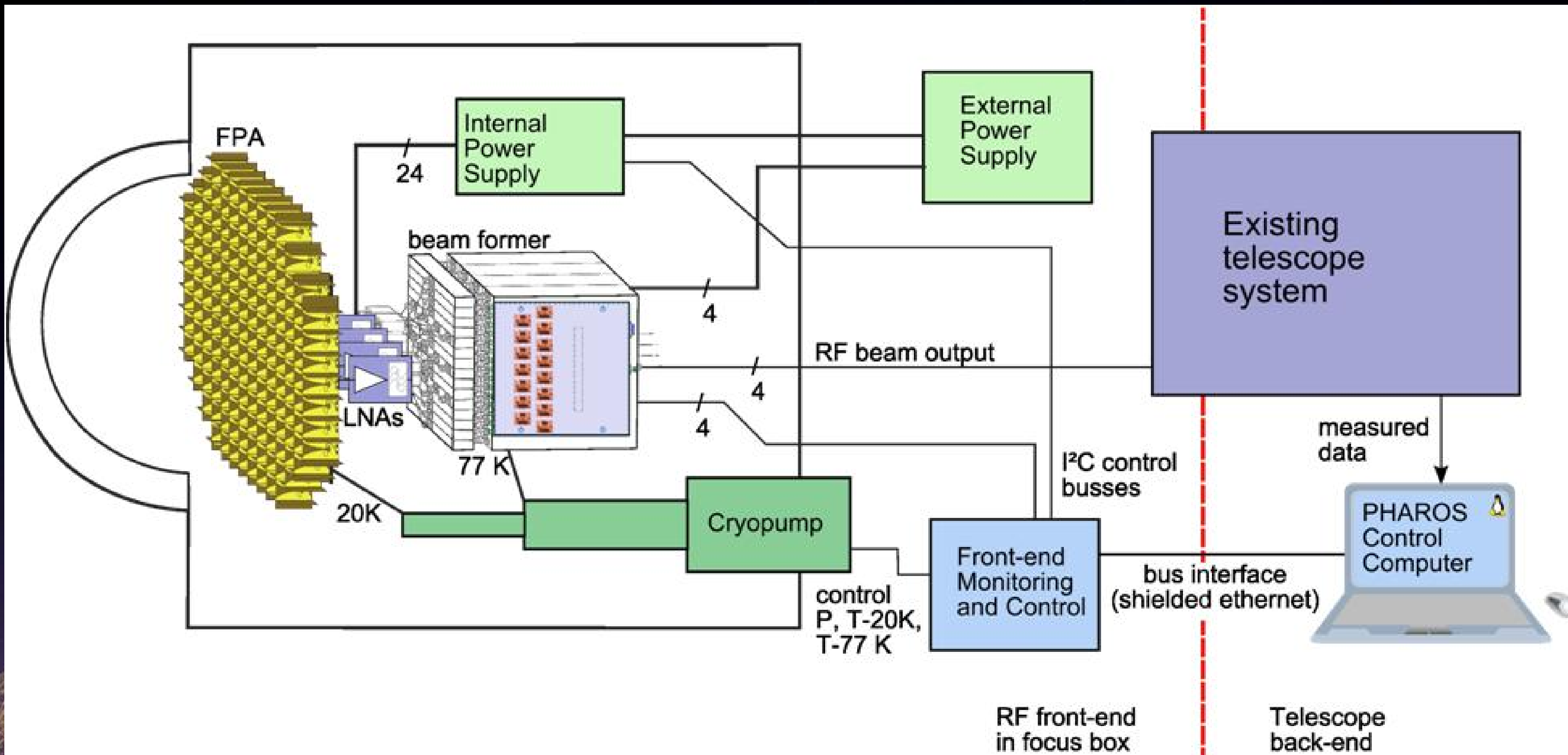
- The key objective of PHAROS is to continue, and bring to fruition, some of the strategic research, begun in the FP5 RTD programme FARADAY (HPRI-CT-2001-50031)
- The partners in PHAROS are Jodrell Bank Observatory (JBO), University of Birmingham, Istituto di Radioastronomia (INAF), Microwave Engineering Centre for Space Applications (MECSA), and Netherlands Foundation for Research in Astronomy (ASTRON)

What PHAROS looks like

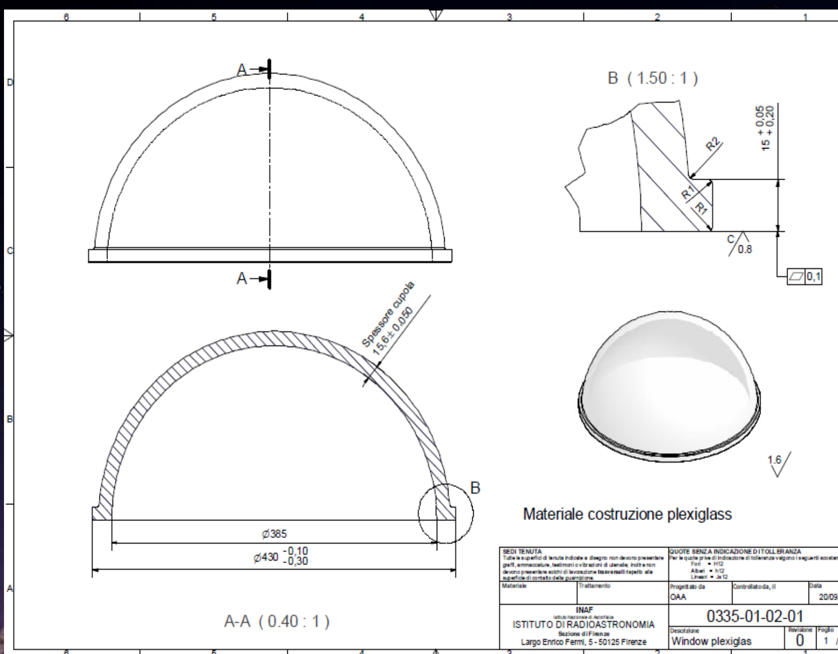


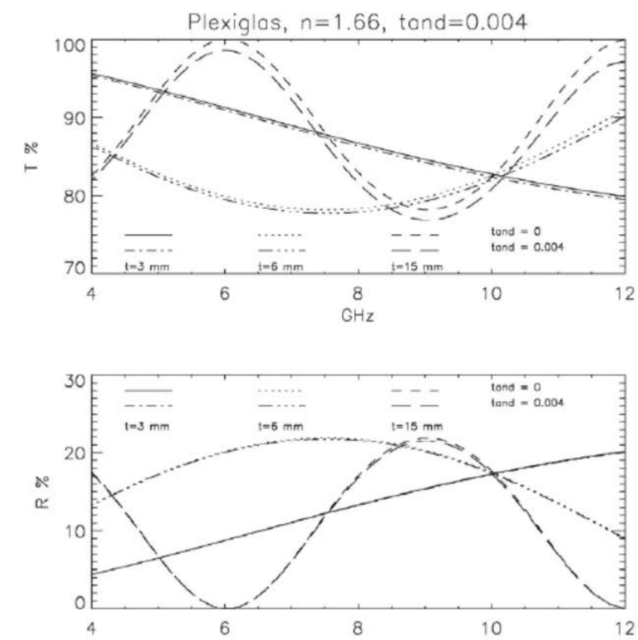


Blocks diagram



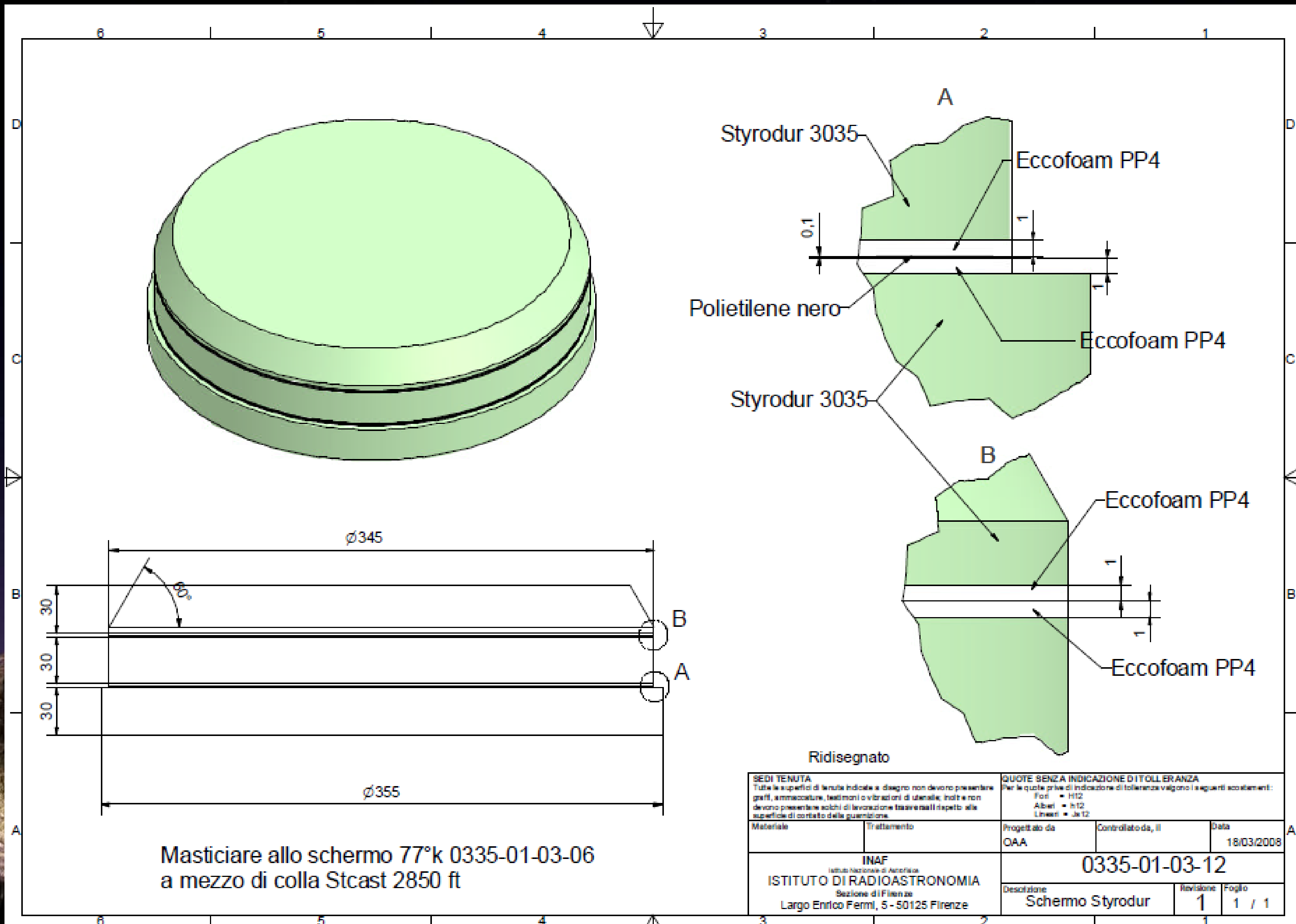
Plexiglas dome window and transparency



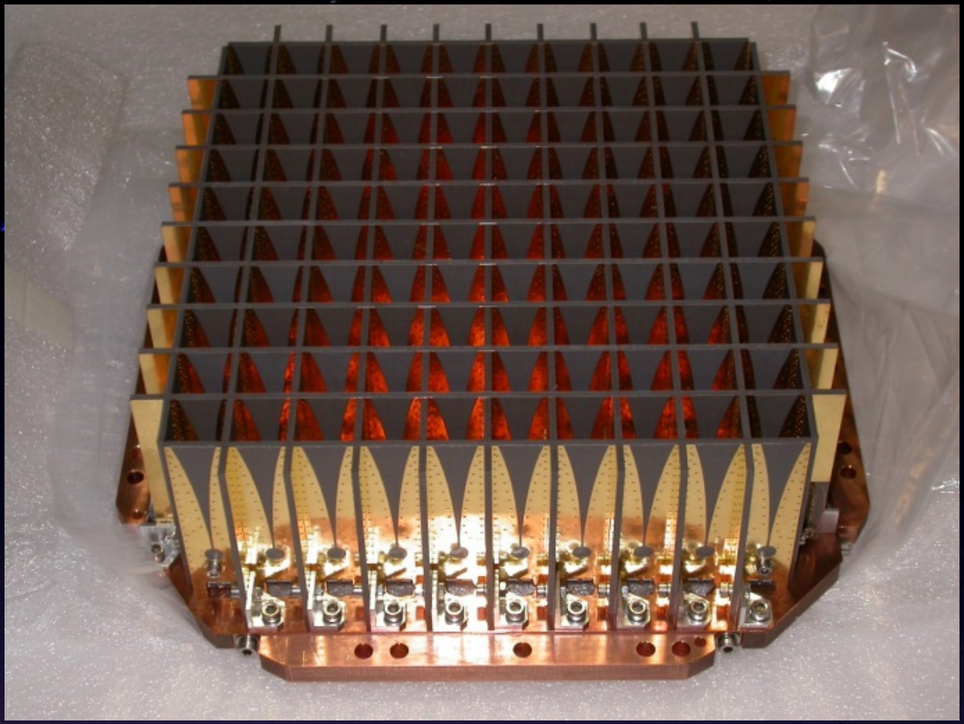


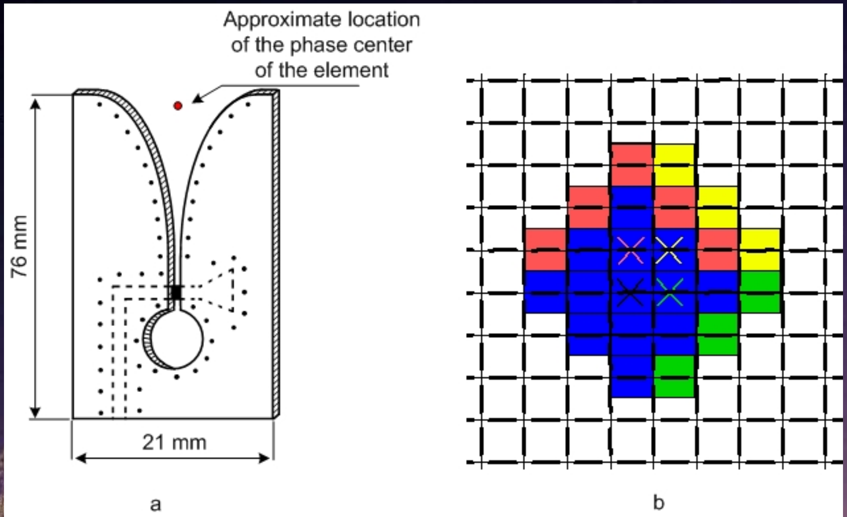
- Transmission and reflection losses
- High epsilon more significant then Tand

IR filter

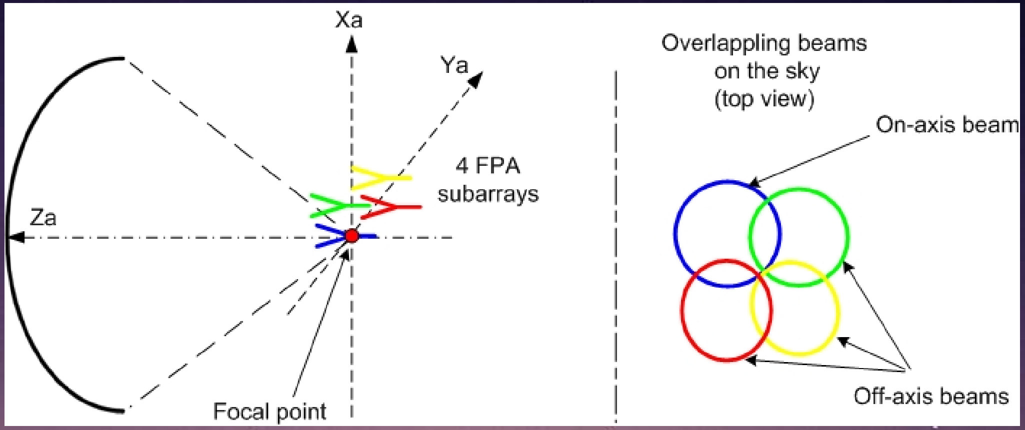

A
Styrodur 3035
Eccofoam PP4
0,1
1
Polietilene nero
Eccofoam PP4
Styrodur 3035
B
Eccofoam PP4
1
1
Eccofoam PP4
⌀345
60°
30
30
30
B
A
⌀355
Masticiare allo schermo 77°k 0335-01-03-06
a mezzo di colla Stcast 2850 ft
Ridisegnato
SEDI TENUTA
Tutte le superfici di tenuta indicate a disegno non devono presentare graffi, ammaccature, testimoni o vibrazioni di utensile; inoltre non devono presentare solchi di lavorazione trasversali rispetto alla superficie di contatto della guarnizione.
QUOTE SENZA INDICAZIONE DI TOLLERANZA
Per le quote prive di indicazione di tolleranza valgono i seguenti scostamenti:
Fori = H12
Alberi = h12
Lineari = Js12
Materiale
Trattamento
Progettato da
OAA
Controllato da, il
Data
18/03/2008
INAF
Istituto Nazionale di Astrofisica
ISTITUTO DI RADIOASTRONOMIA
Sezione di Firenze
Largo Enrico Fermi, 5 - 50125 Firenze
0335-01-03-12
Descrizione
Schermo Styrodur
Revisione
1
Foglio
1 / 1

Vivaldi antenna



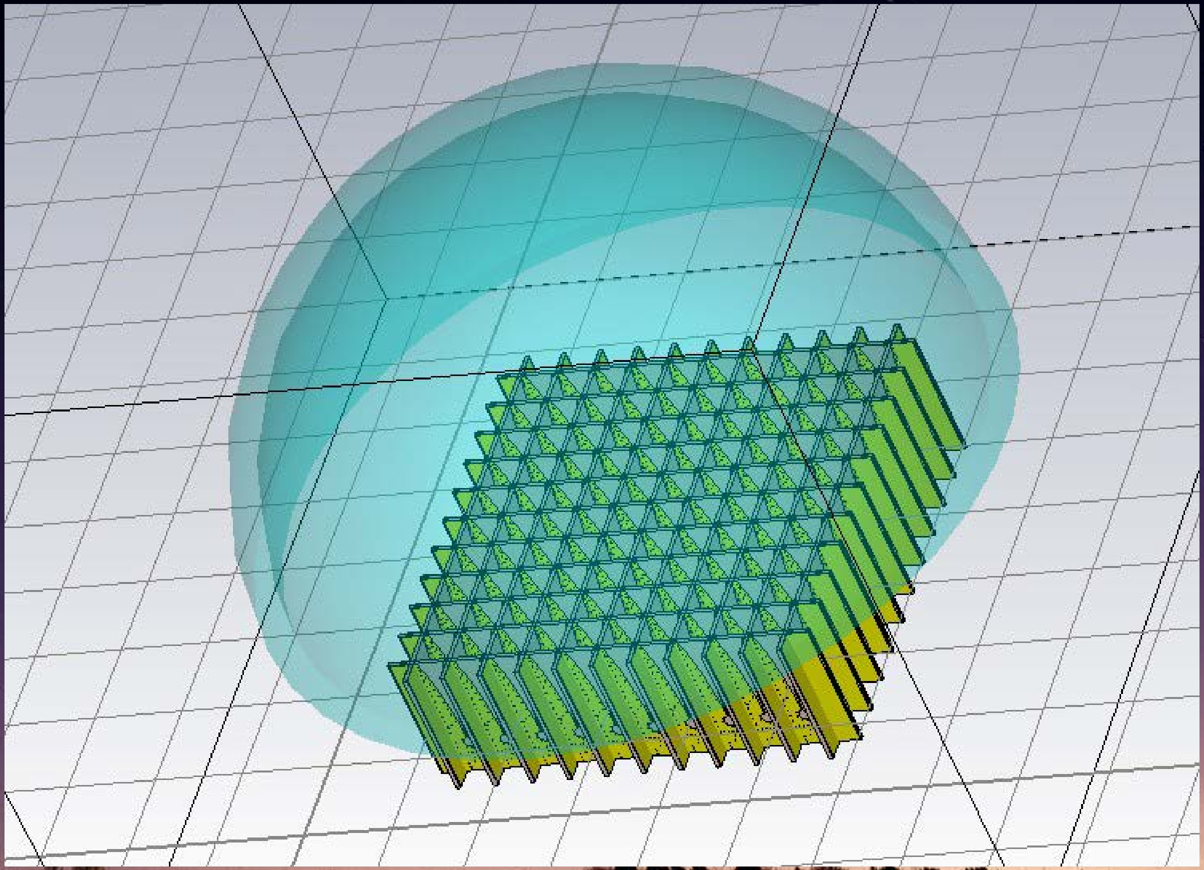


The geometry of the array element (a) and schematic of the subarrays (b).

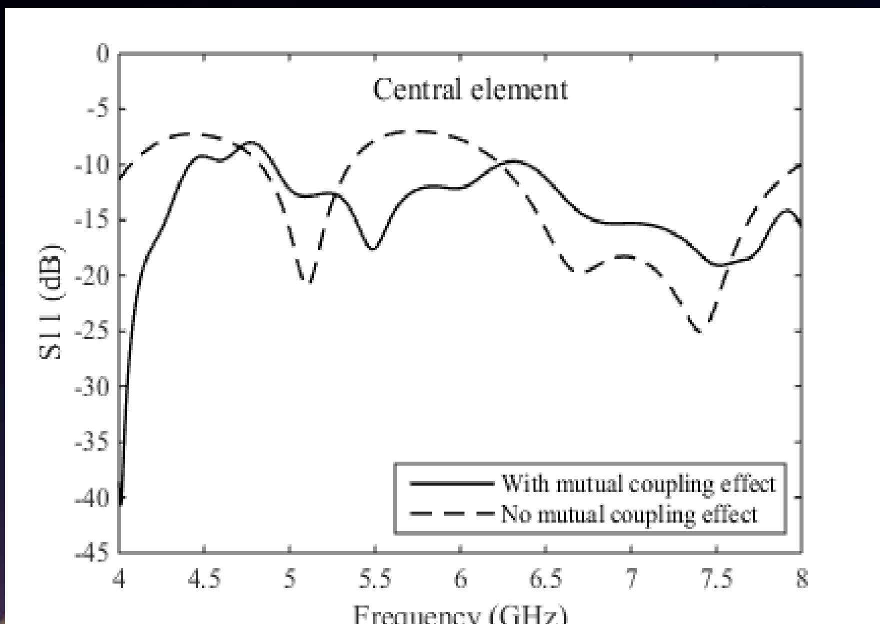


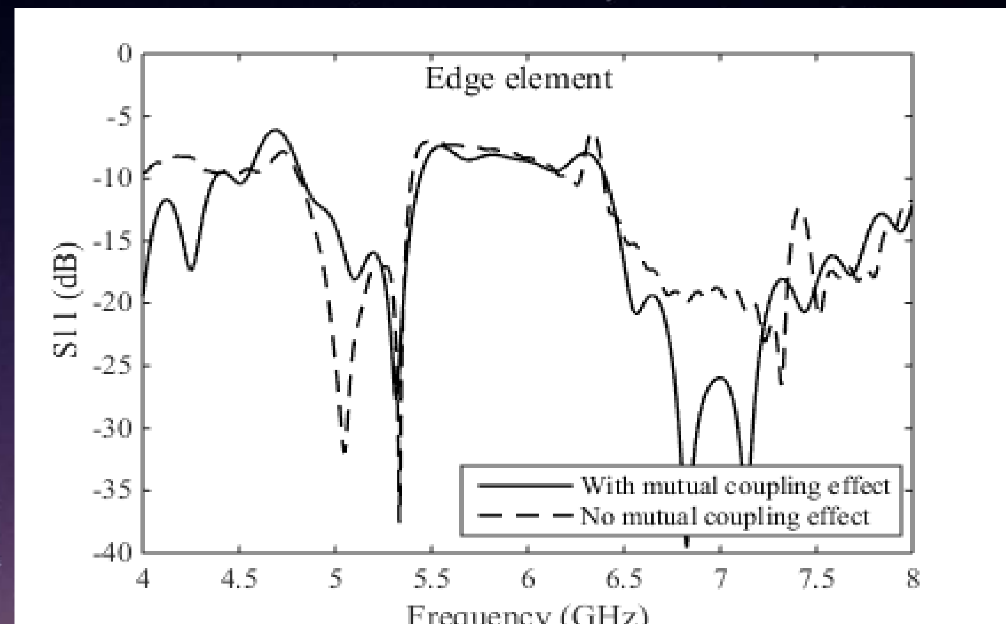
Positions of subarrays in the focal region of reflector and corresponding beams on the sky

Investigation of reflection co-efficiency and farfield pattern with/without effect of Plexiglas window

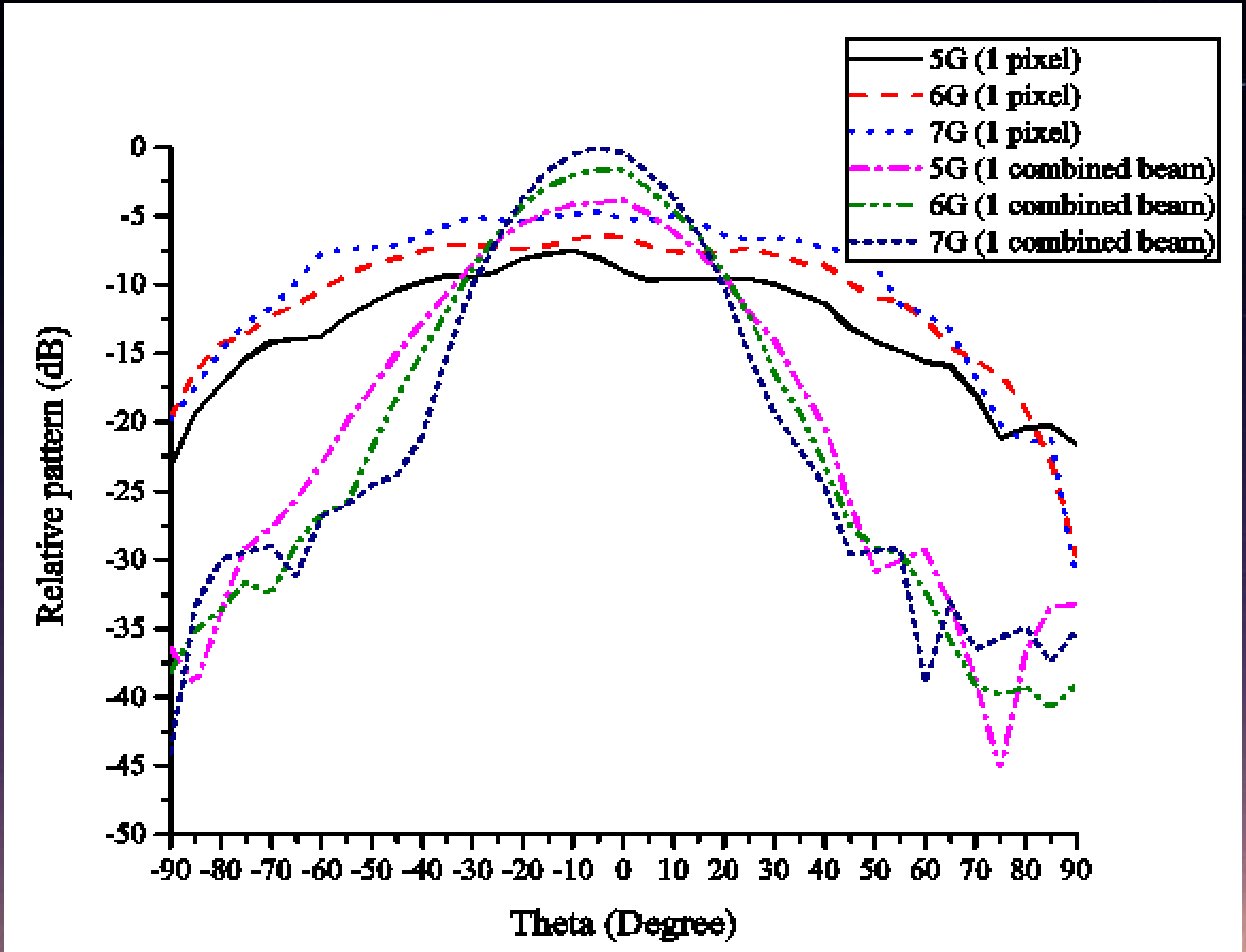


Reflection co-efficiency of a single element affected by mutual coupling





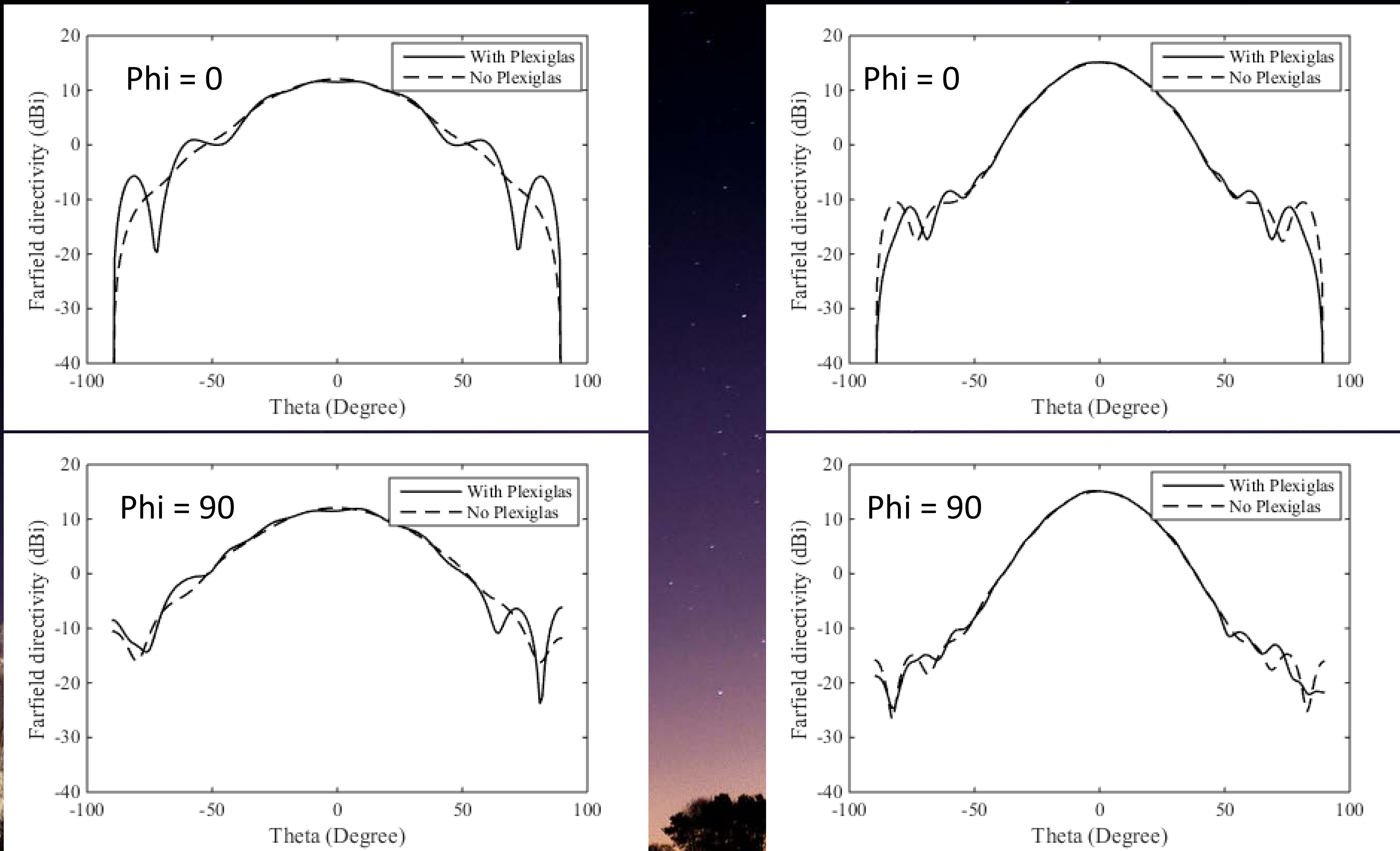
Radiation pattern test results



Radiation pattern affected by Plexiglas window

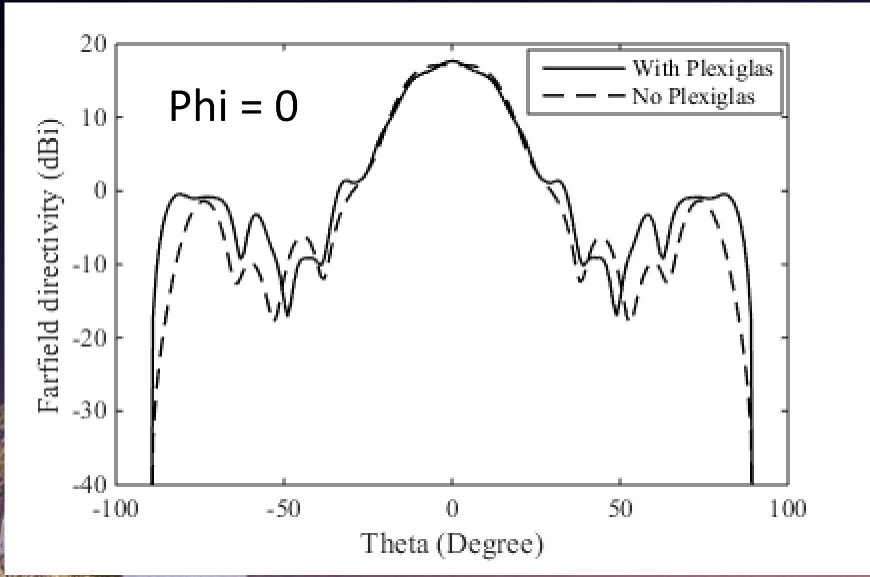
4 G

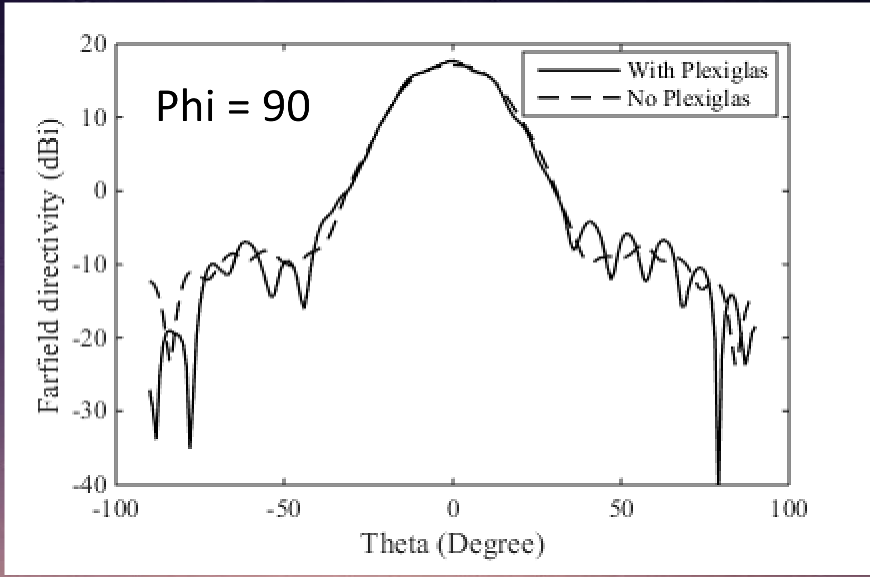
6 G

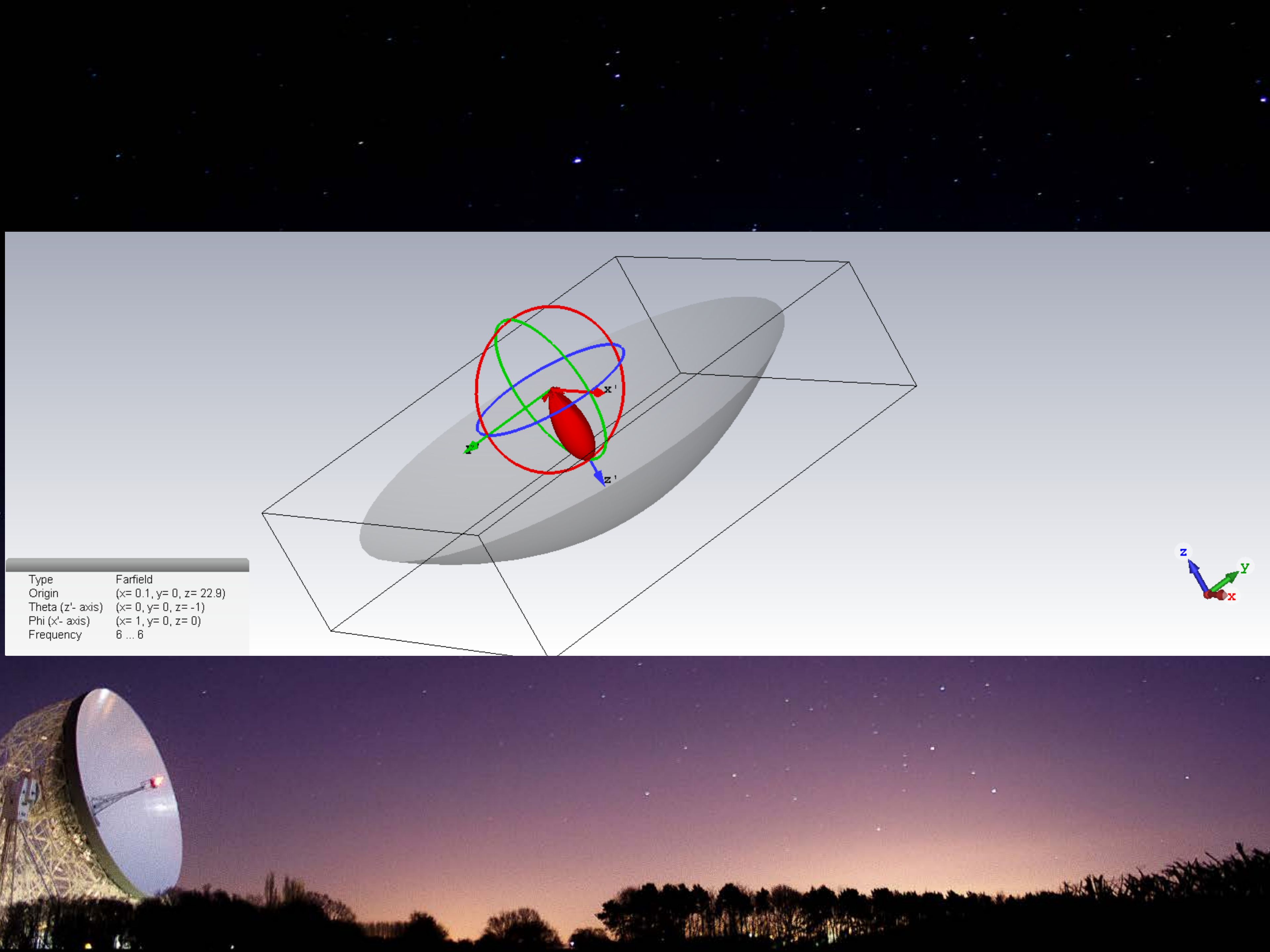


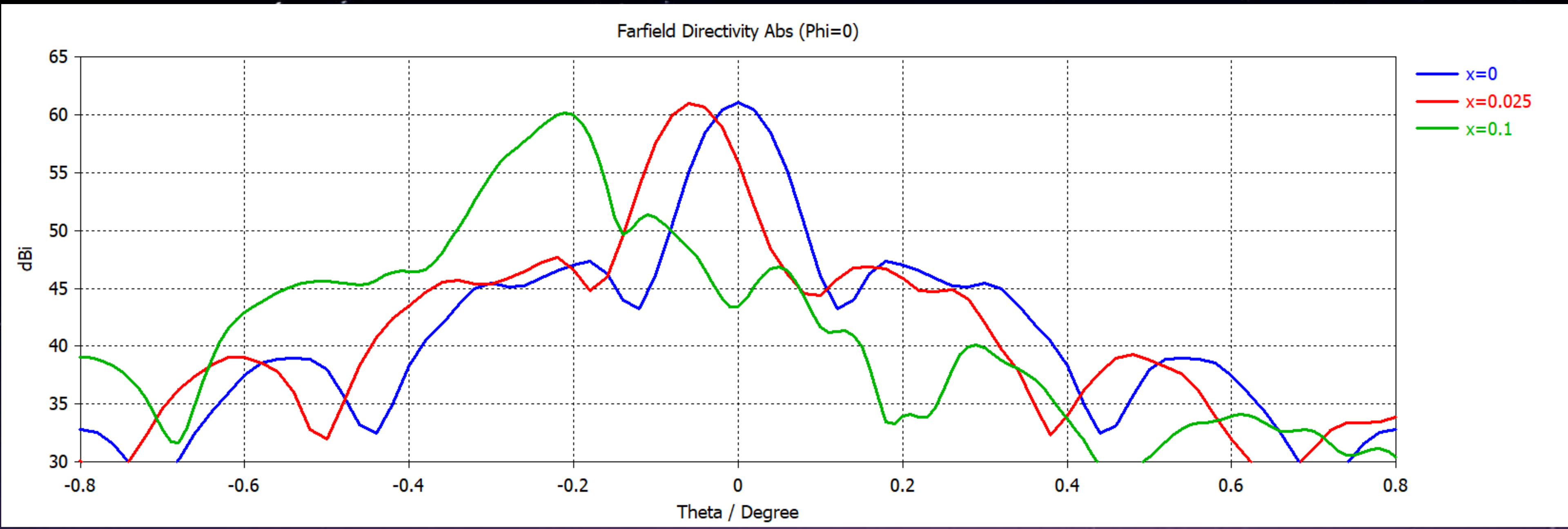
Radiation pattern affected by Plexiglas window

8 G

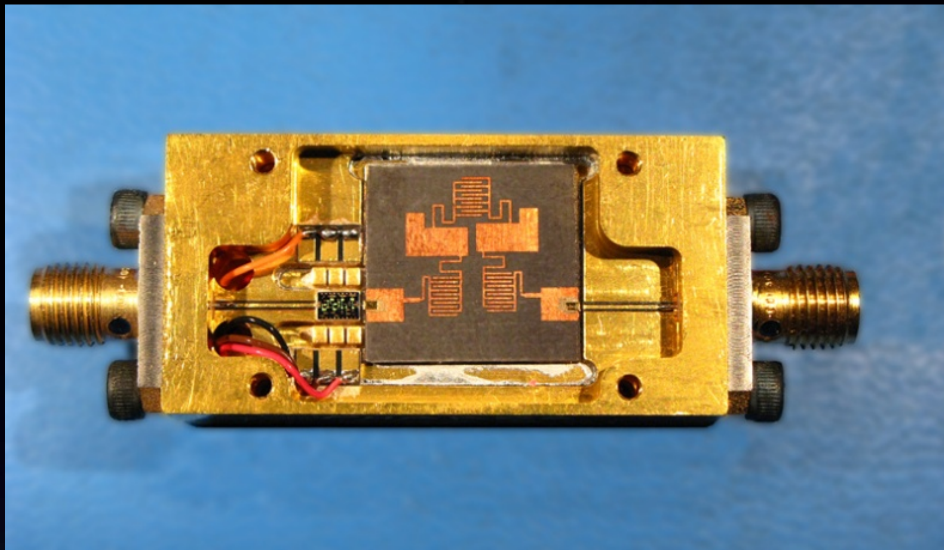


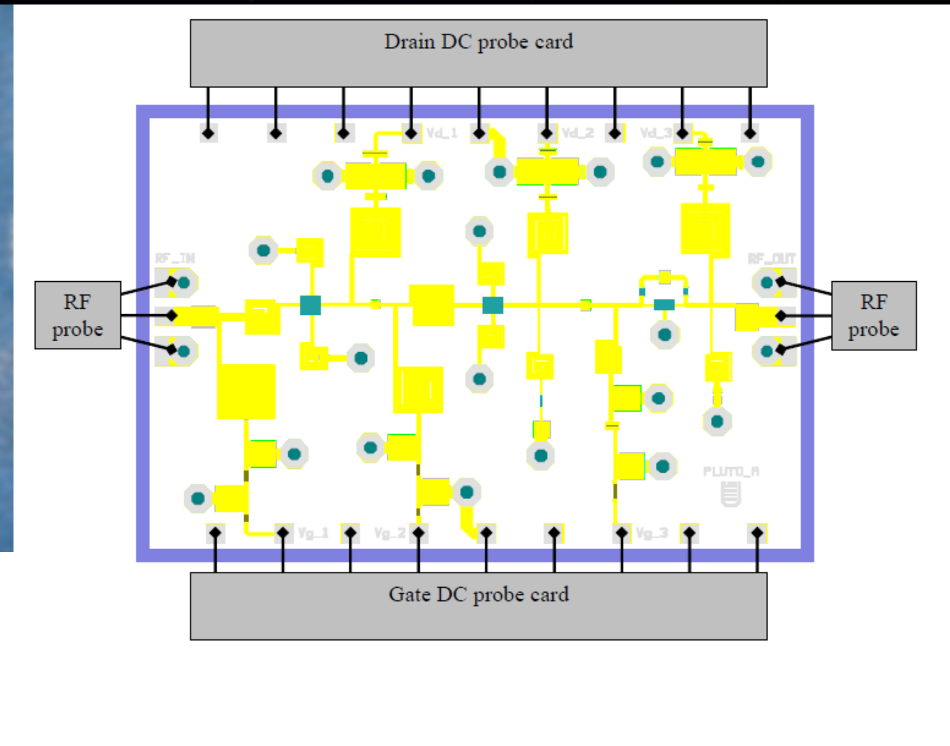


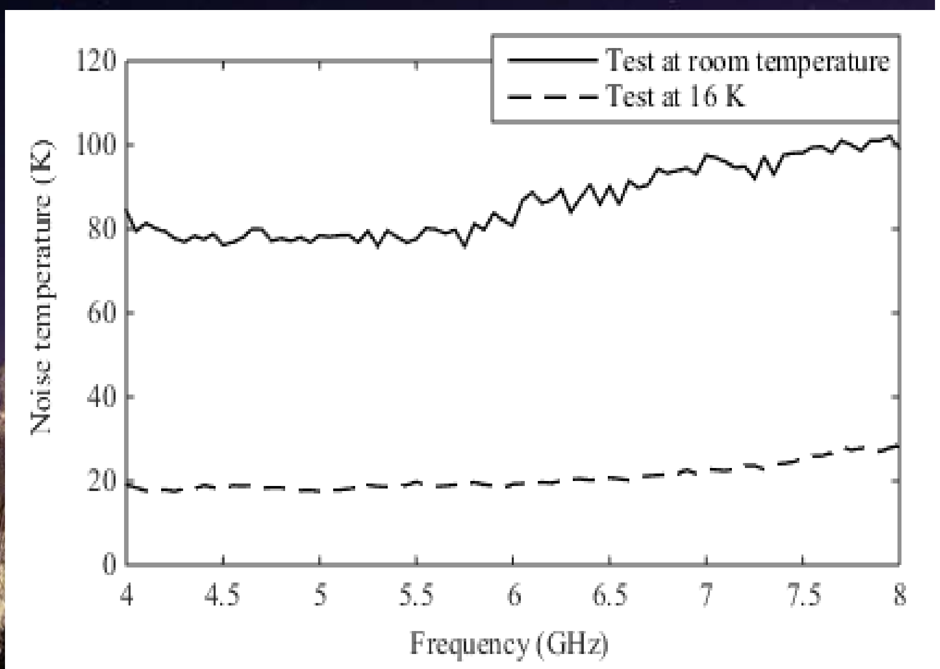

Type Farfield
Origin (x= 0.1, y= 0, z= 22.9)
Theta (z'- axis) (x= 0, y= 0, z= -1)
Phi (x'- axis) (x= 1, y= 0, z= 0)
Frequency 6 ... 6


Farfield Directivity Abs (Phi=0)
dBi
65
60
55
50
45
40
35
30
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
Theta / Degree
x=0
x=0.025
x=0.1

MMIC LNA + filter



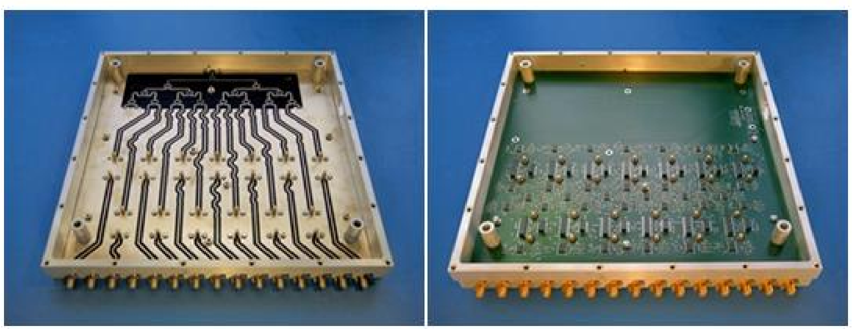




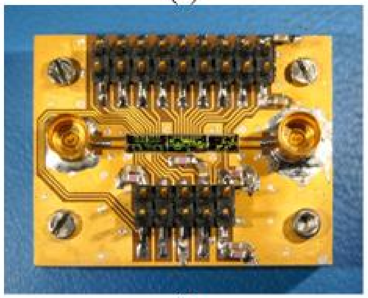
Inside view of MMIC

Beam former module

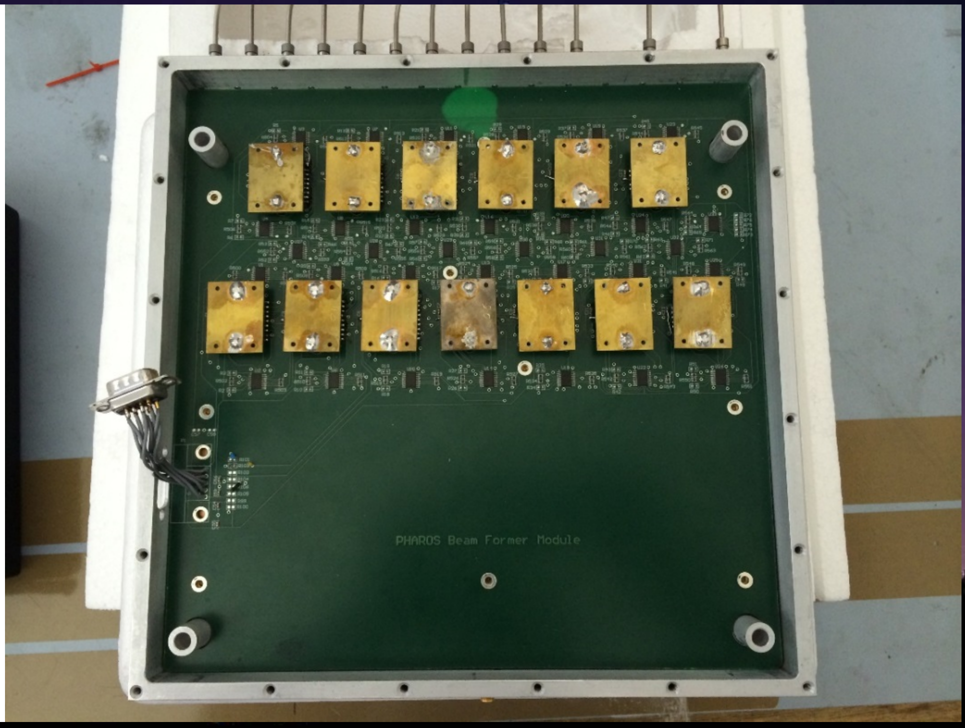
1. RF board
2. Digital control board
3. Phase and amplitude control module (PAC)



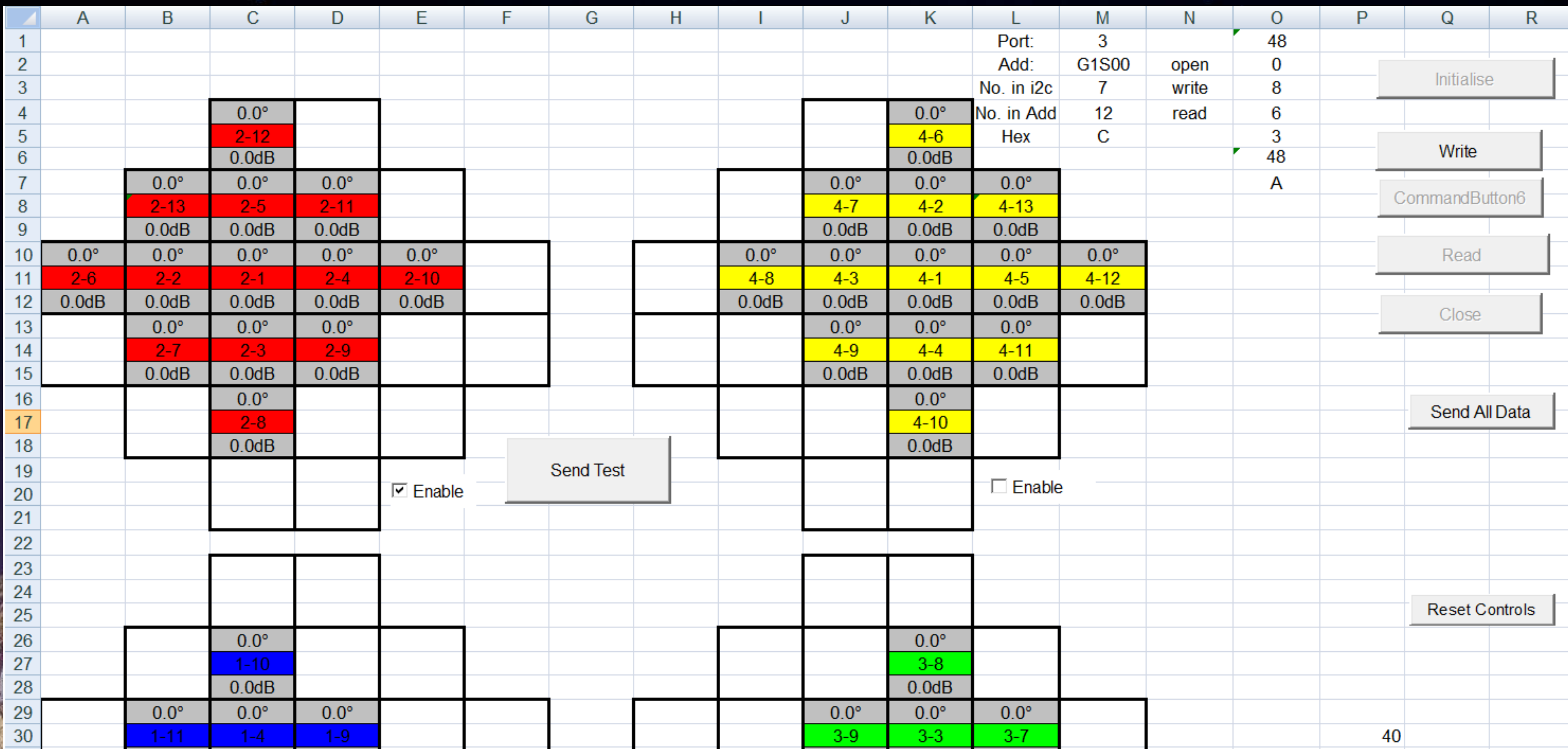
(a)



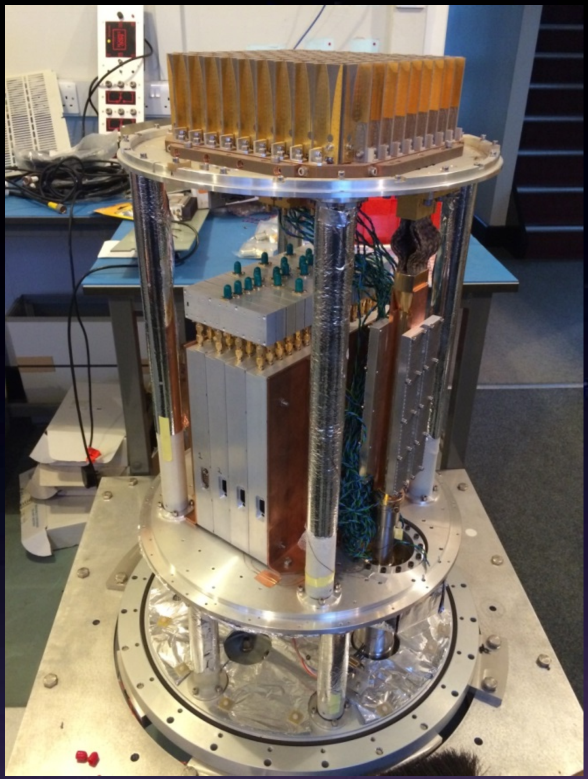
(b)



Beam former control UI

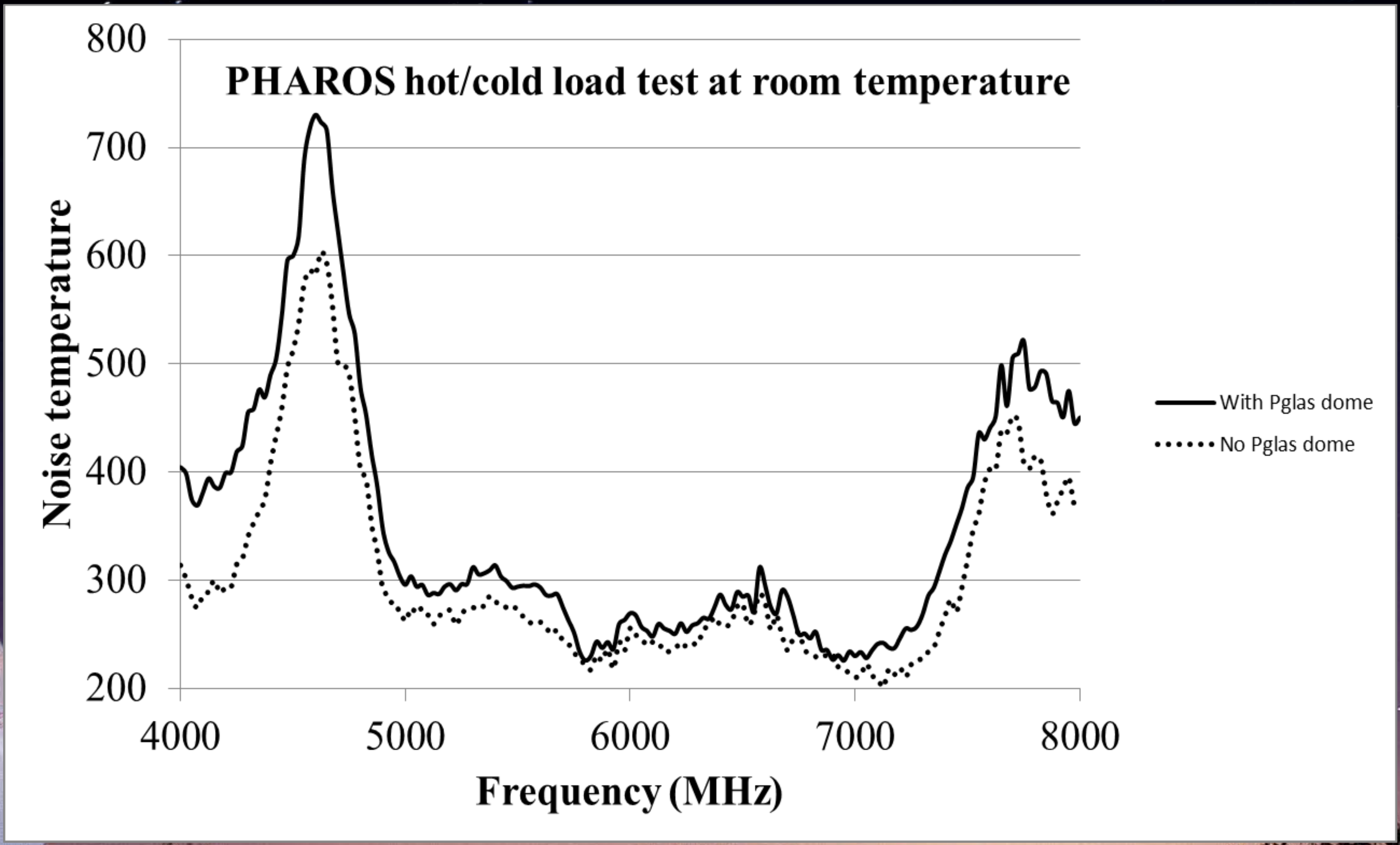


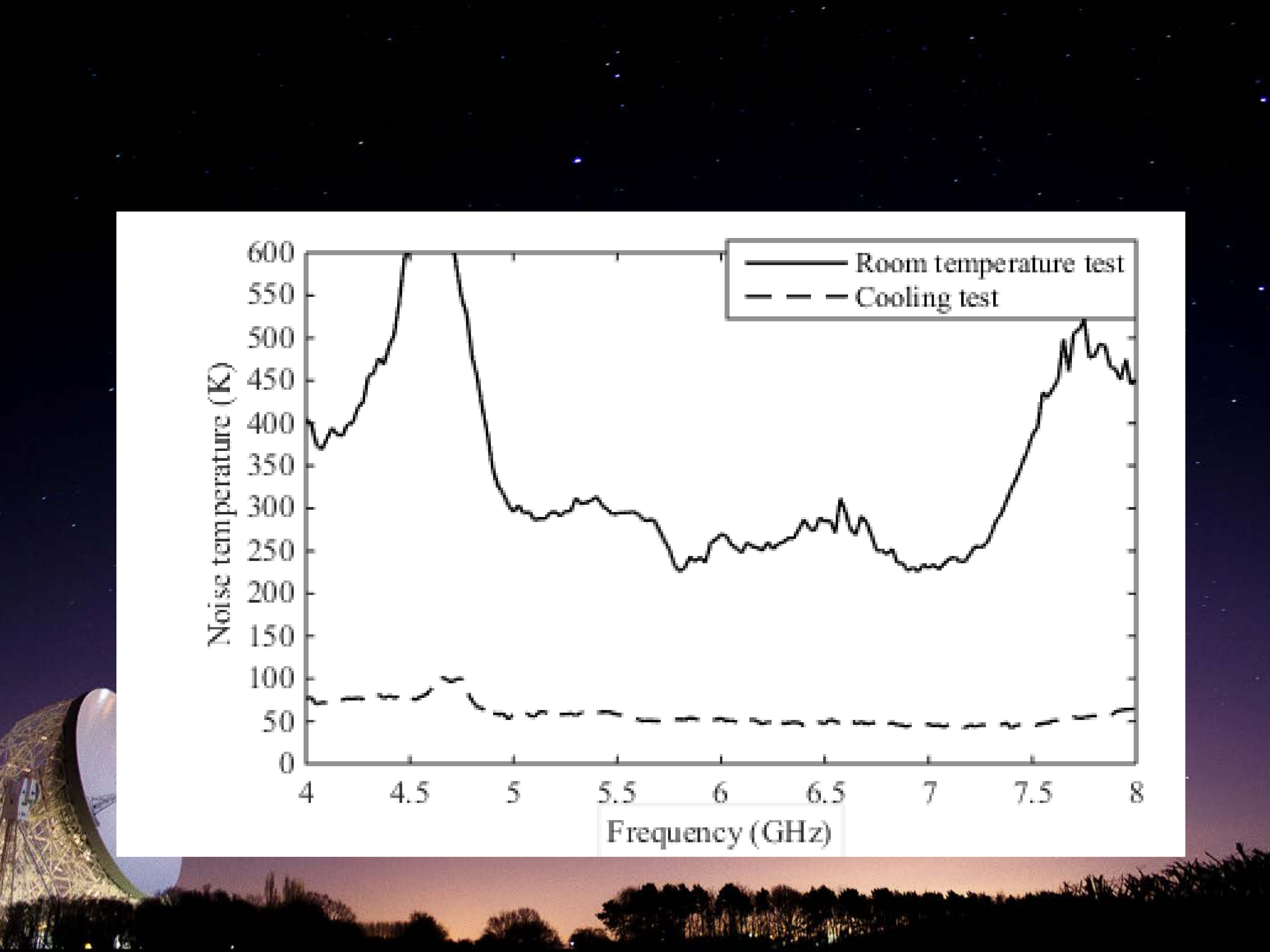
Cryostat integration



Trx test set up

Noise temperature of PHAROS receiver




Room temperature test
Cooling test
Noise temperature (K)
600
550
500
450
400
350
300
250
200
150
100
50
0
4
4.5
5
5.5
6
6.5
7
7.5
8
Frequency (GHz)

Upgrade

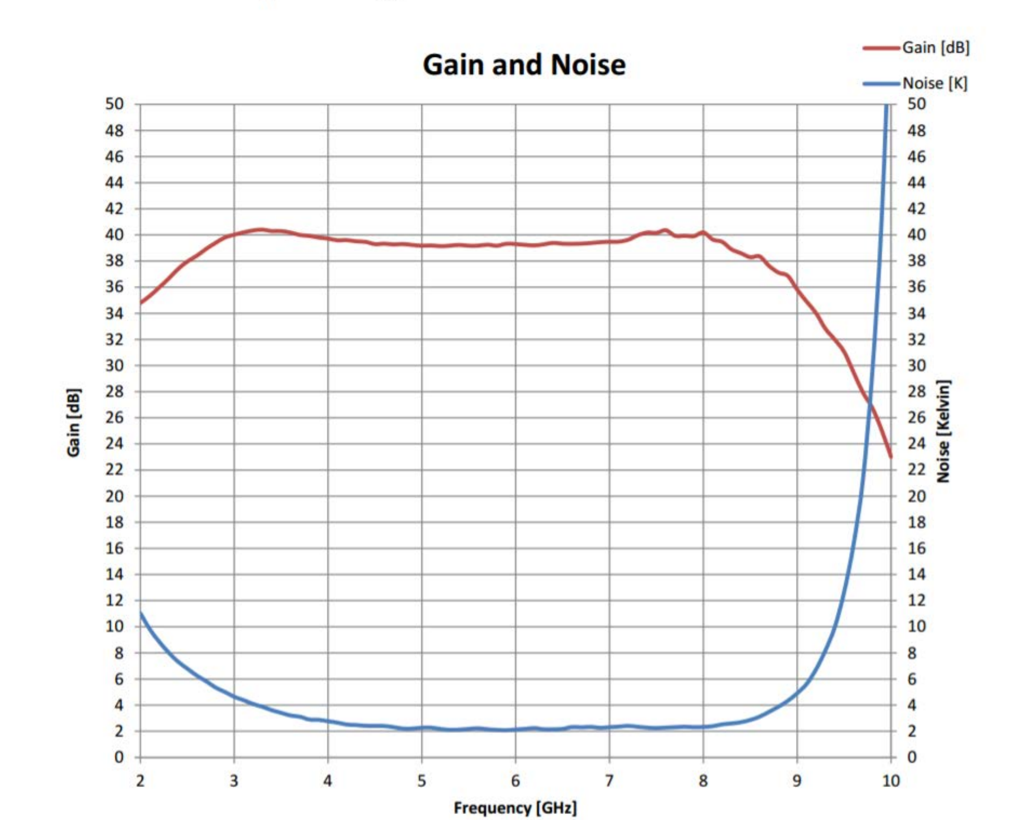
- New radome window (Uman & UChalmers)
- Array design better for cryogenically cooling (UChalmers)
- Low Noise Amplifiers (LNF)
- Digital beam forming (INAF)

Low Noise Amplifiers

FEATURES

- RF bandwidth: 4-8 GHz
- Noise Temperature: 2.3 K typical
- Noise Figure: 0.034 dB typical
- Gain: 39 dB
- DC-power: Vd=0.50 V, Id=8 mA
- One gate and one drain supply only
- RF-connectors: female SMA
- DC-connector: 9-pin female Nano-D

Measured typical data T_{amb}=5 K



Q & A

Thanks for attending.