Antennas Overview

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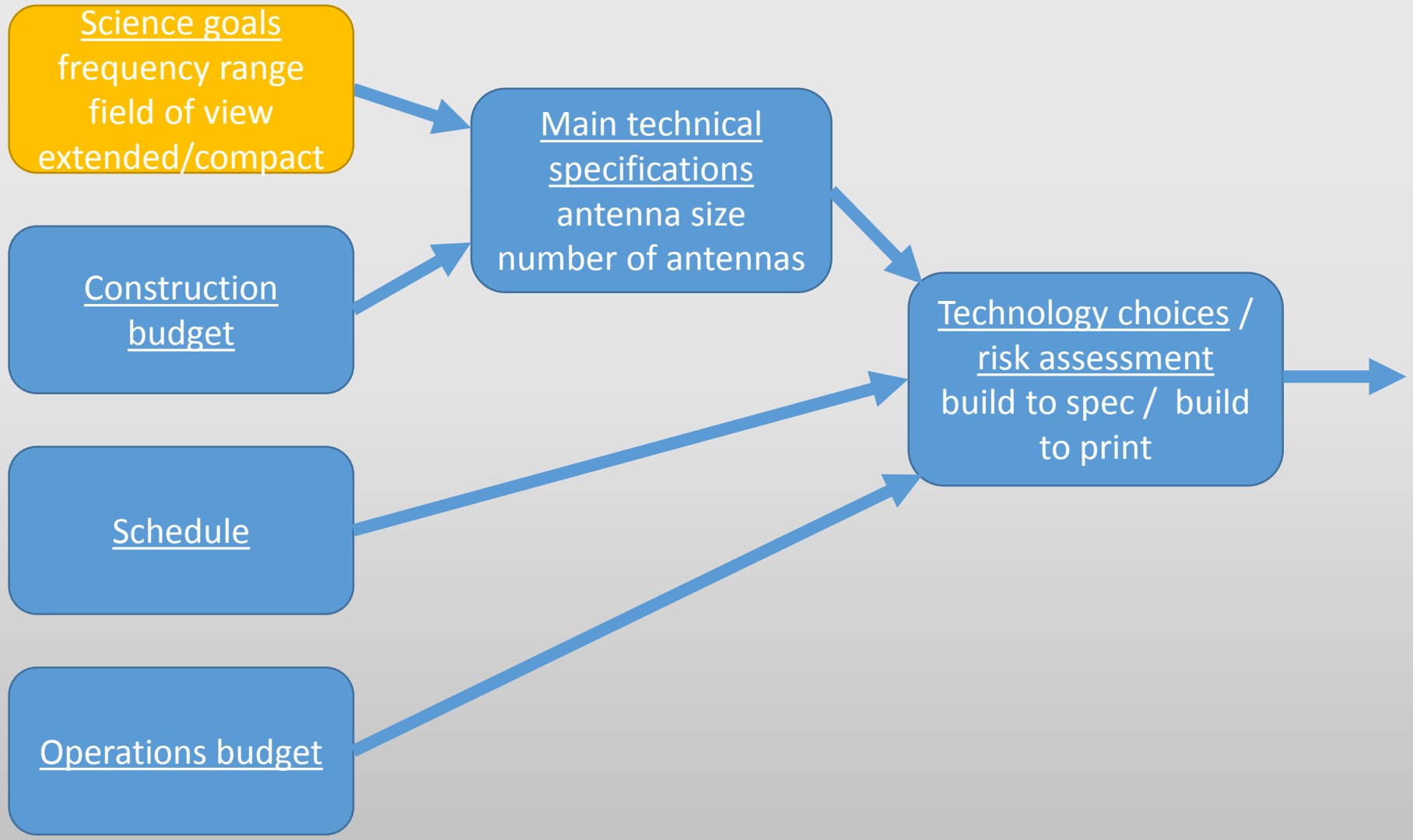
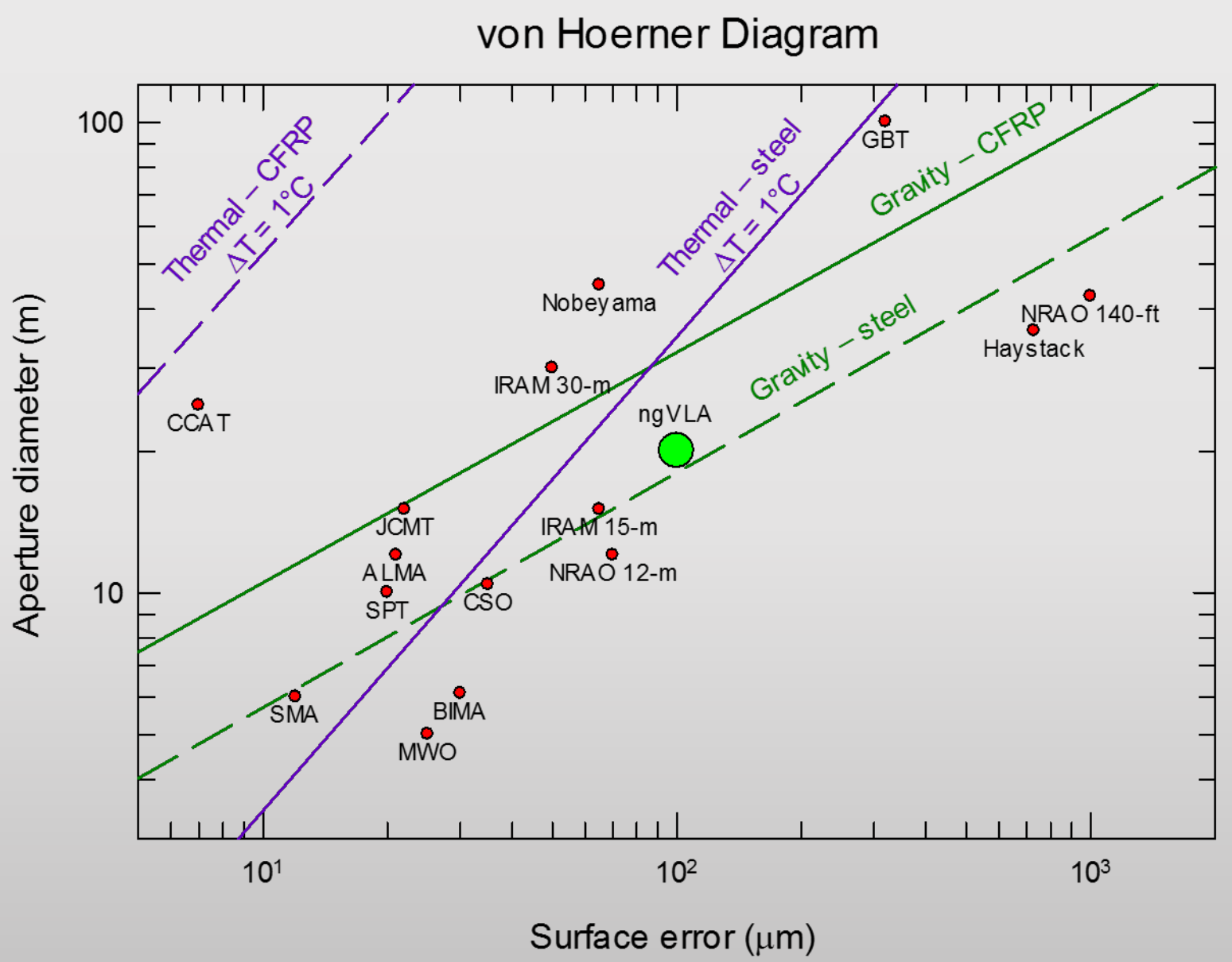
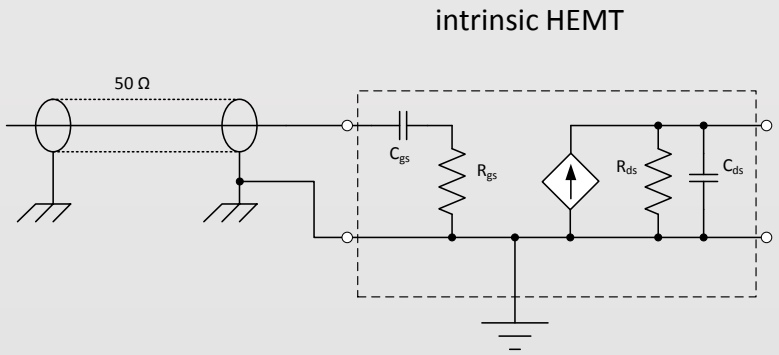
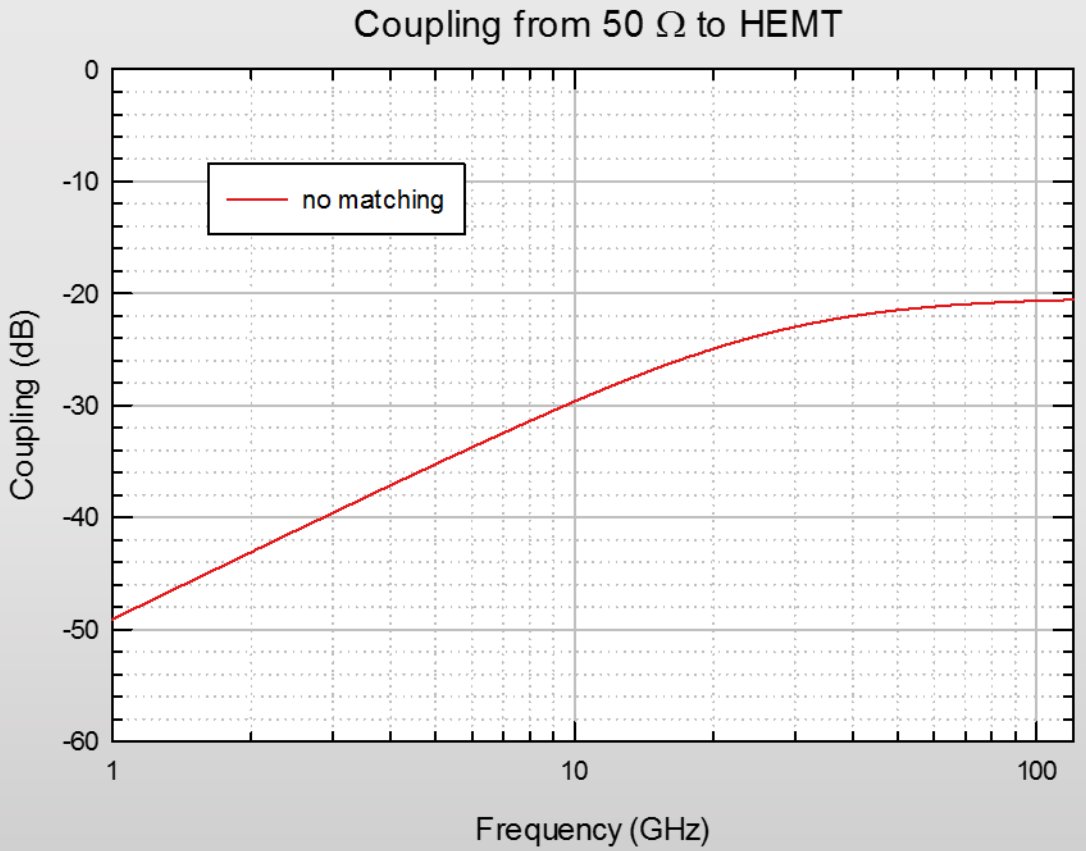
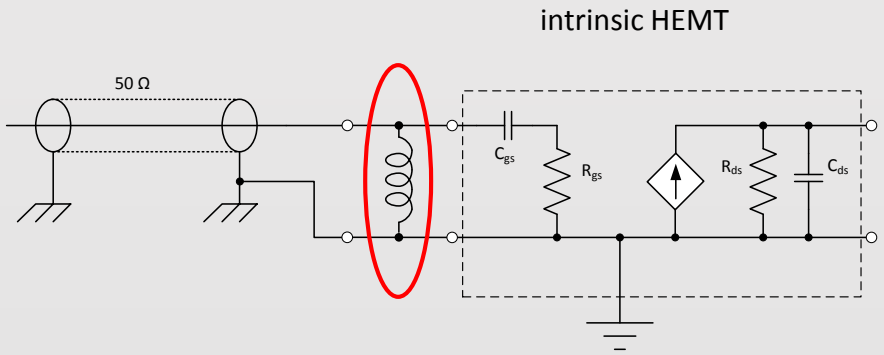
Owens Valley: antennas in their natural habitat

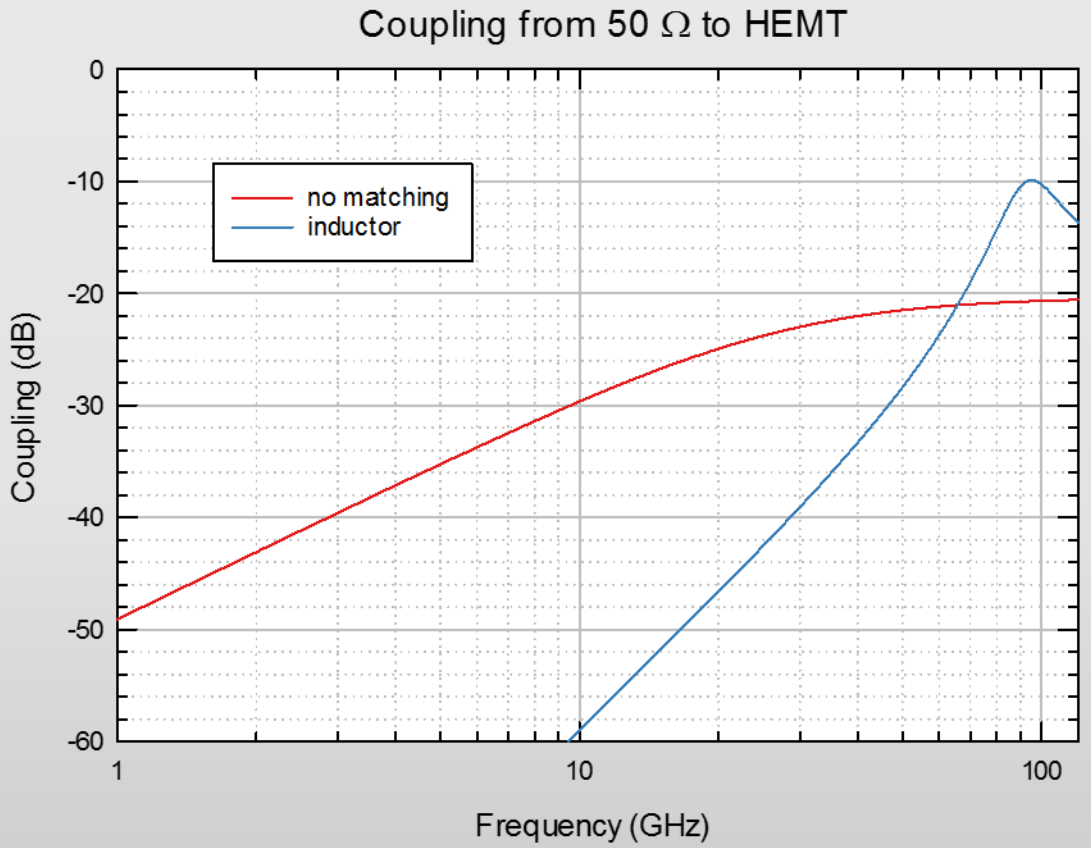

Science goals
frequency range
field of view
extended/compact
Construction budget
Schedule
Operations budget
Main technical specifications
antenna size
number of antennas
Technology choices / risk assessment
build to spec / build to print

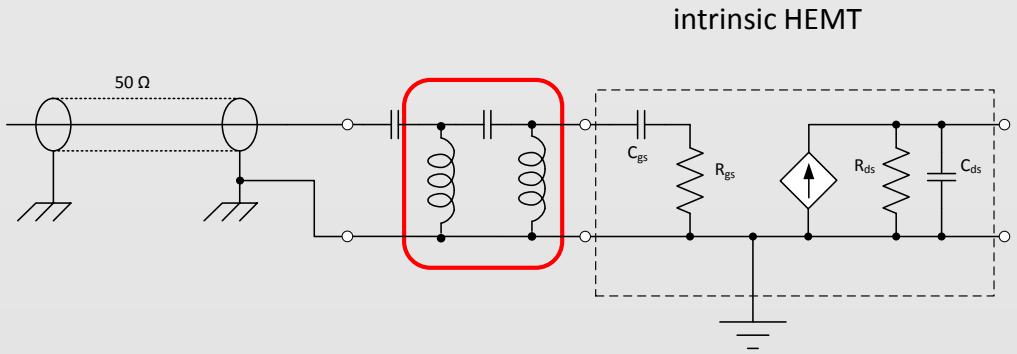

von Hoerner Diagram
Aperture diameter (m)
100
10
Surface error (μm)
10^1
10^2
10^3
Thermal – CFRP
ΔT = 1°C
Thermal – steel
ΔT = 1°C
Gravity – CFRP
Gravity – steel
GBT
Nobeyama
NRAO 140-ft
Haystack
IRAM 30-m
CCAT
ngVLA
JCMT
IRAM 15-m
ALMA
NRAO 12-m
SPT
CSO
SMA
BIMA
MWO

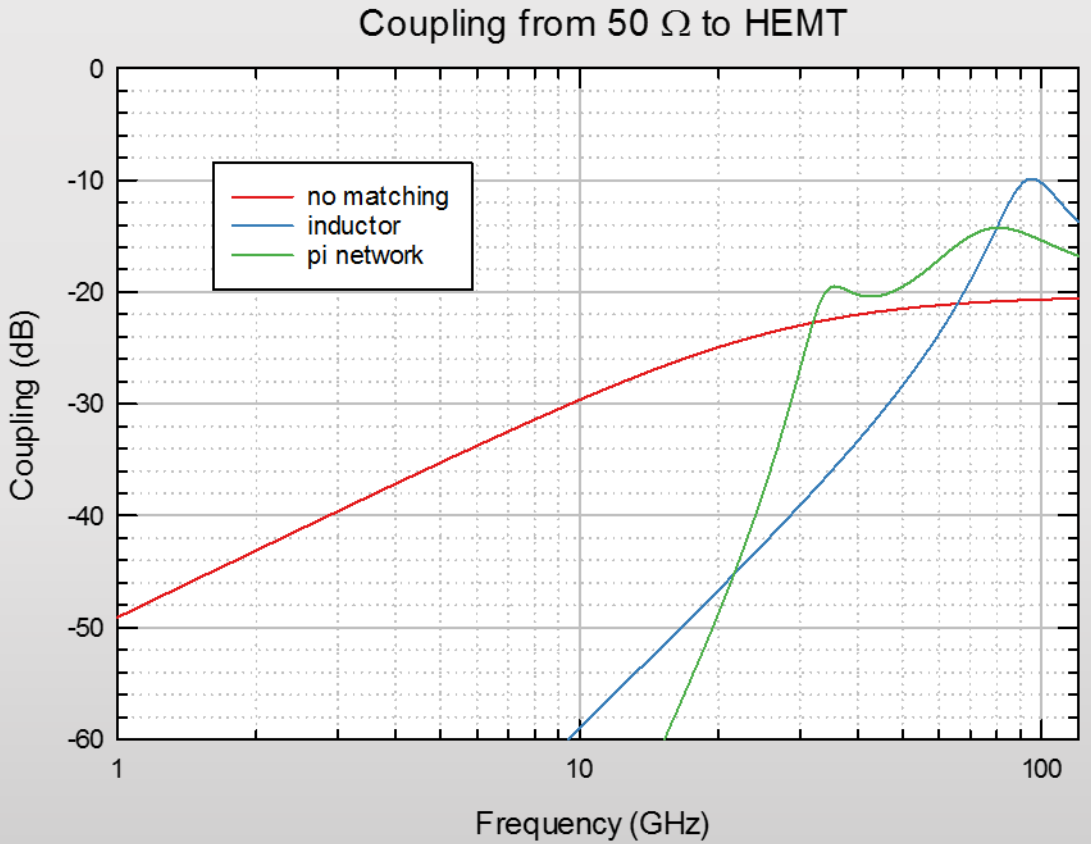

intrinsic HEMT
50 Ω
C_{gs}
R_{gs}
R_{ds}
C_{ds}

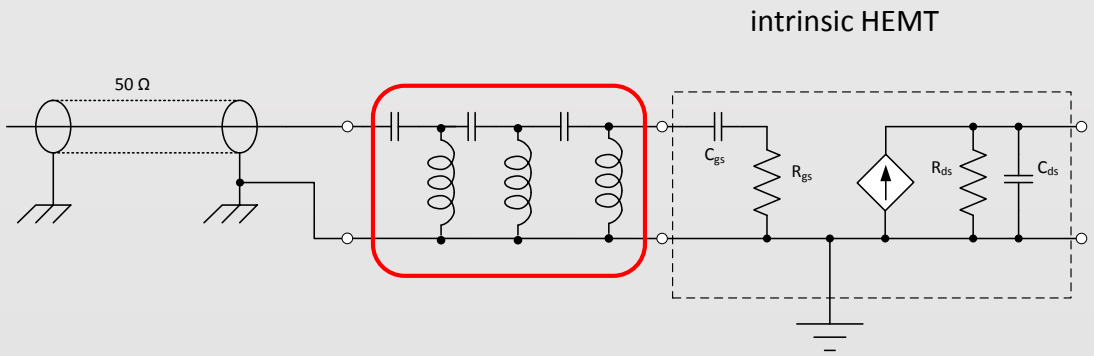

Coupling from 50 Ω to HEMT
no matching
Coupling (dB)
0
-10
-20
-30
-40
-50
-60
1
10
100
Frequency (GHz)

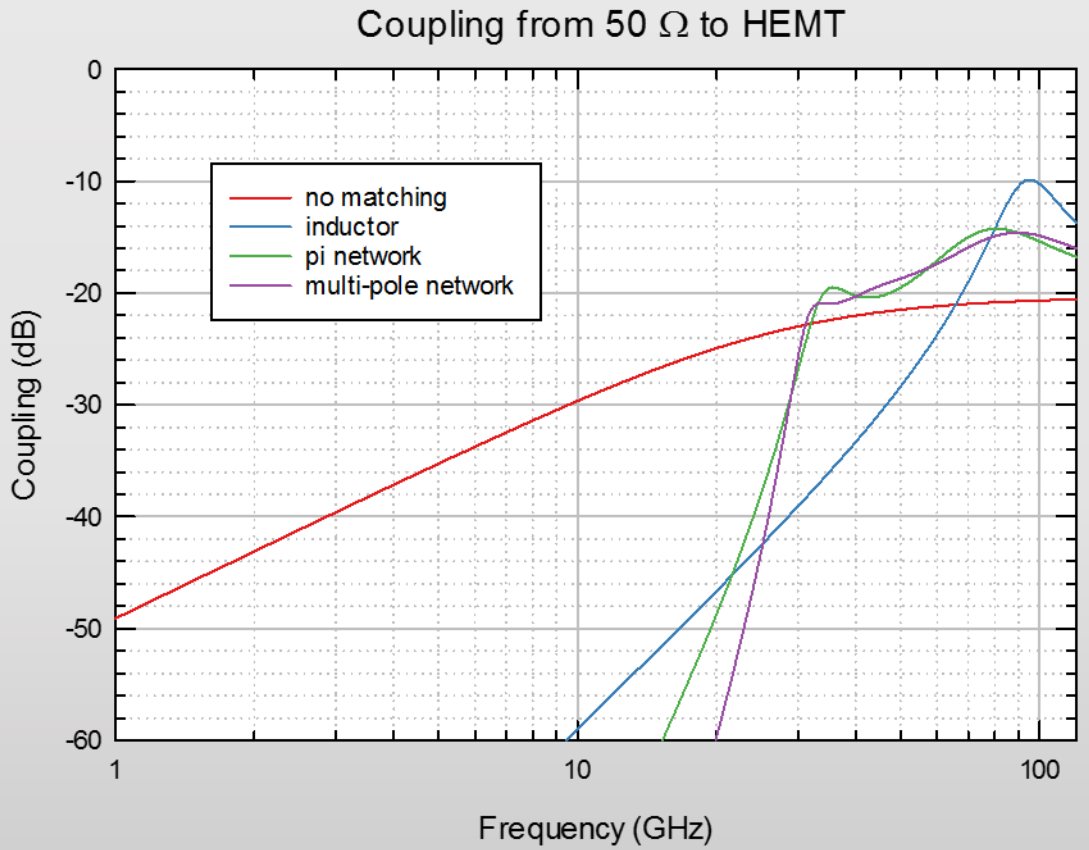

intrinsic HEMT
50 Ω
C_{gs}
R_{gs}
R_{ds}
C_{ds}


Coupling from 50 Ω to HEMT
no matching
inductor
Coupling (dB)
0
-10
-20
-30
-40
-50
-60
1
10
100
Frequency (GHz)


intrinsic HEMT
50 Ω
C_{gs}
R_{gs}
R_{ds}
C_{ds}

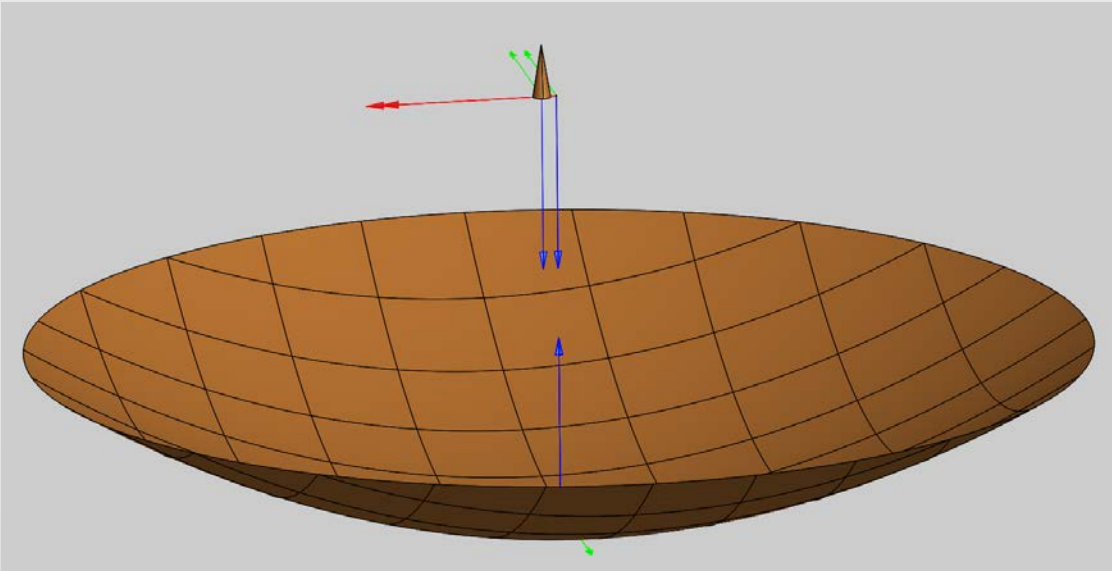

Coupling from 50 Ω to HEMT
no matching
inductor
pi network
Coupling (dB)
0
-10
-20
-30
-40
-50
-60
1
10
100
Frequency (GHz)

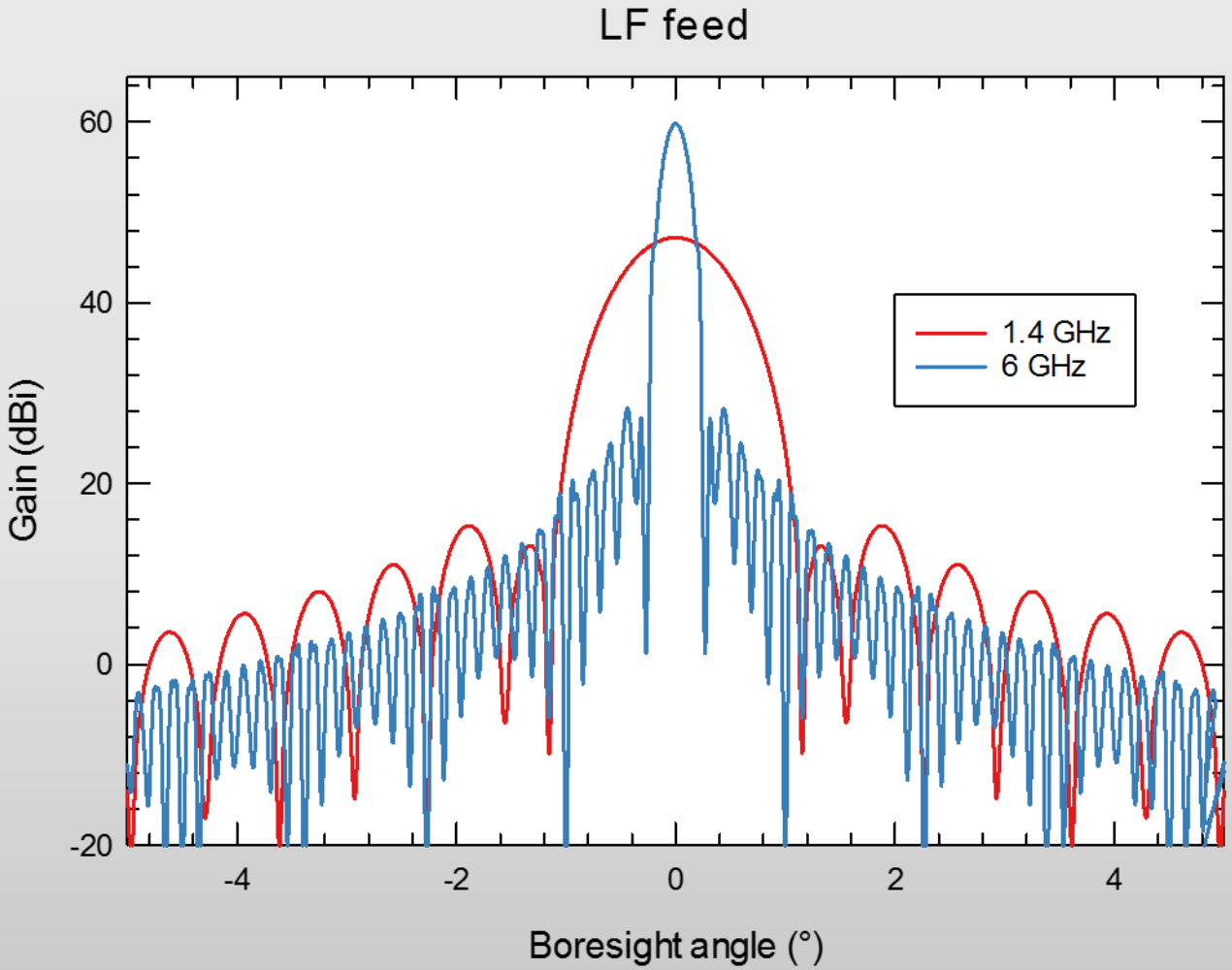

intrinsic HEMT
50 Ω
C_{gs}
R_{gs}
R_{ds}
C_{ds}


Coupling from 50 Ω to HEMT
no matching
inductor
pi network
multi-pole network
Coupling (dB)
0
-10
-20
-30
-40
-50
-60
1
10
100
Frequency (GHz)

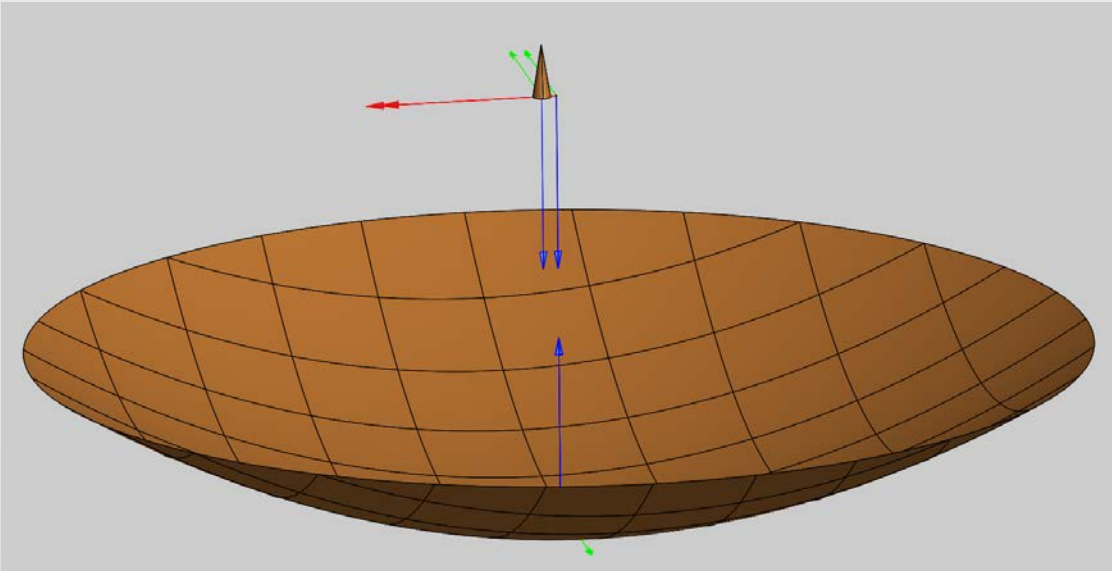
- It is almost certain that ngVLA will require more than one amplifier band
- Also unlikely that a single feed can cover a single band
- So, have to deal with multiple feeds on antennas
  - feeds in focal lane; repoint
  - move feeds (dewar)

Offset feeds on prime-focus antenna

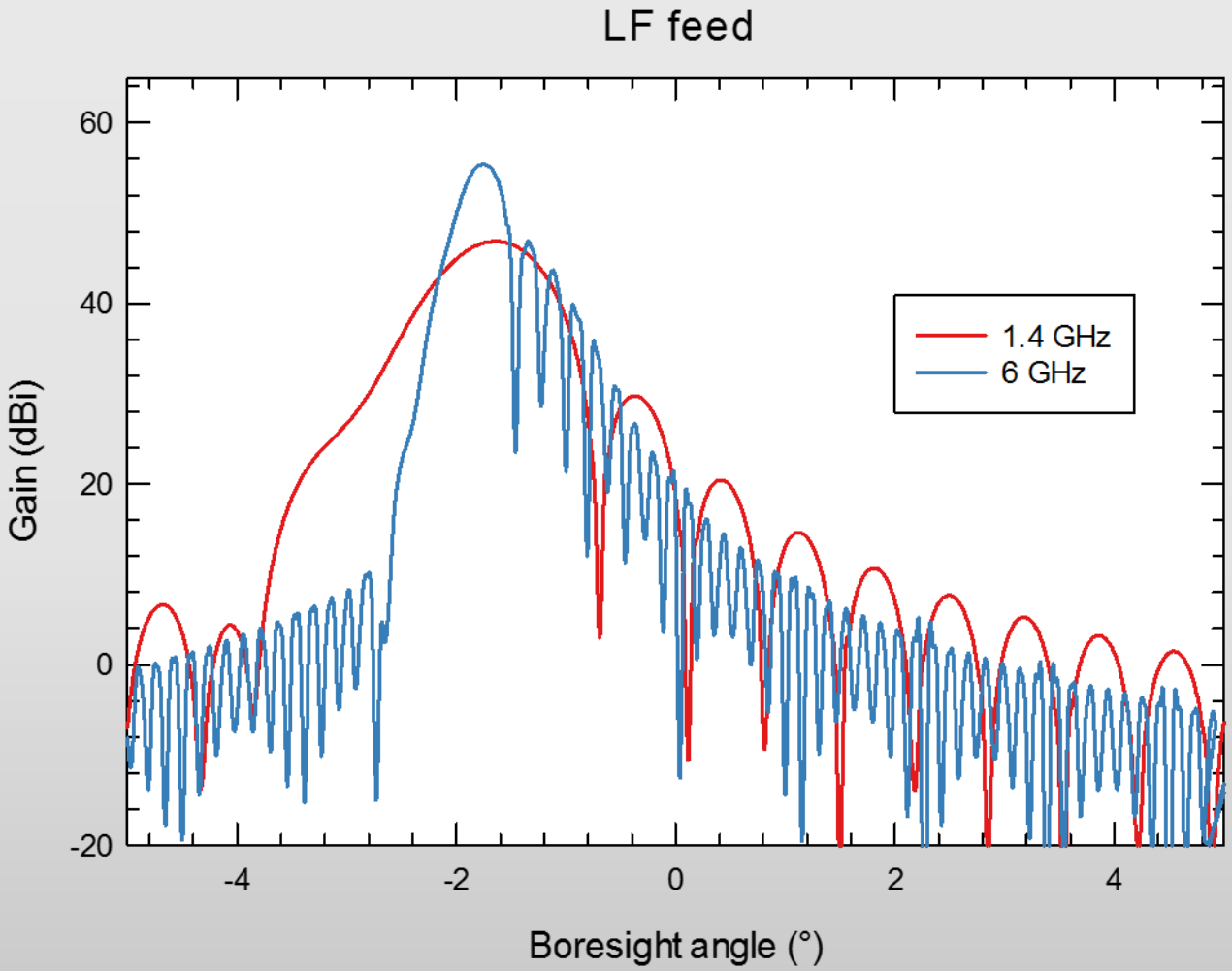




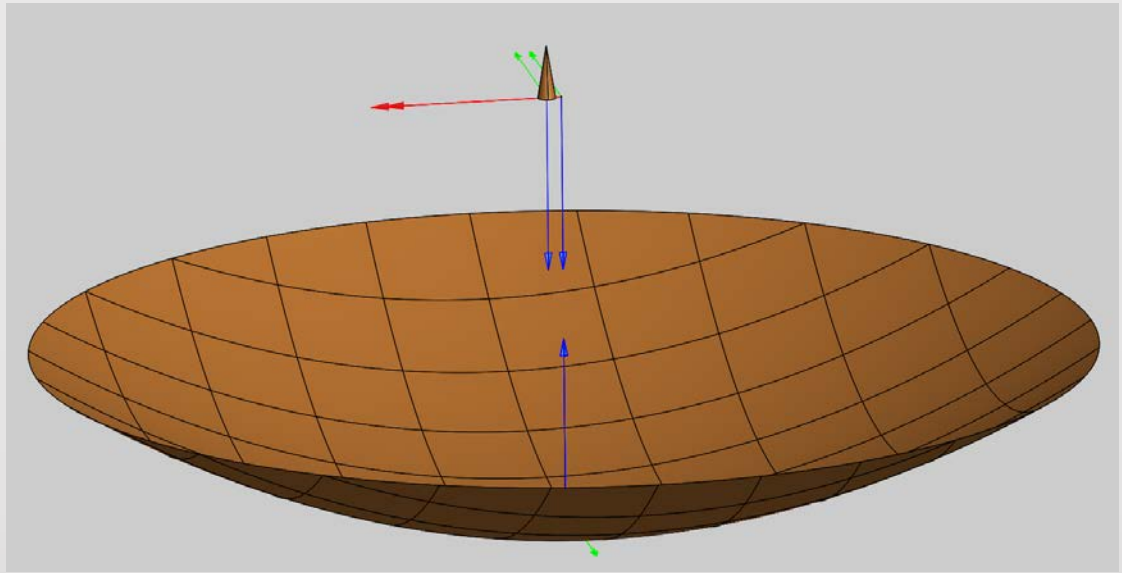
Offset feeds on prime-focus antenna

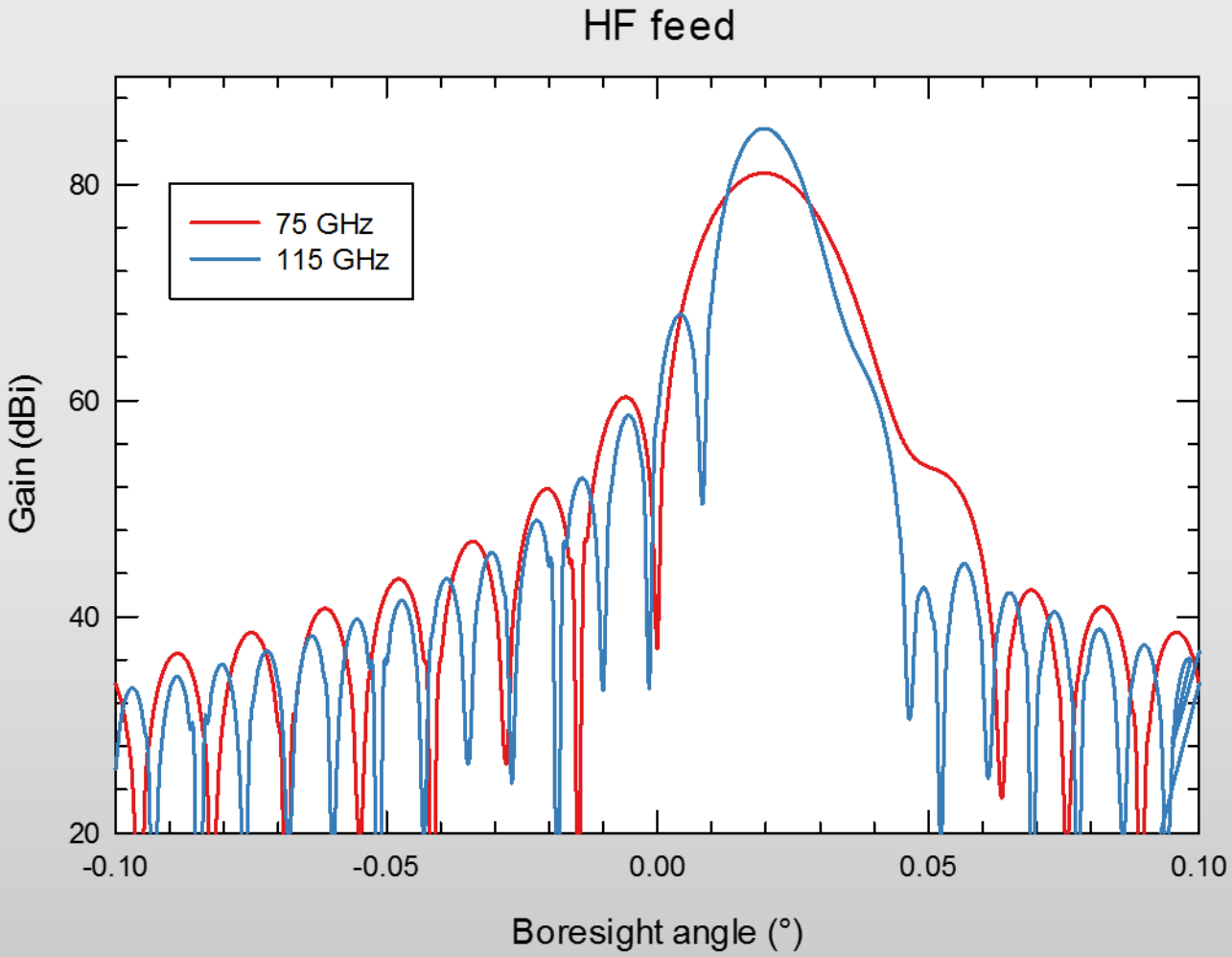


Freq (GHz)	Rel. Eff.
1.4	0.93
6.0	0.36

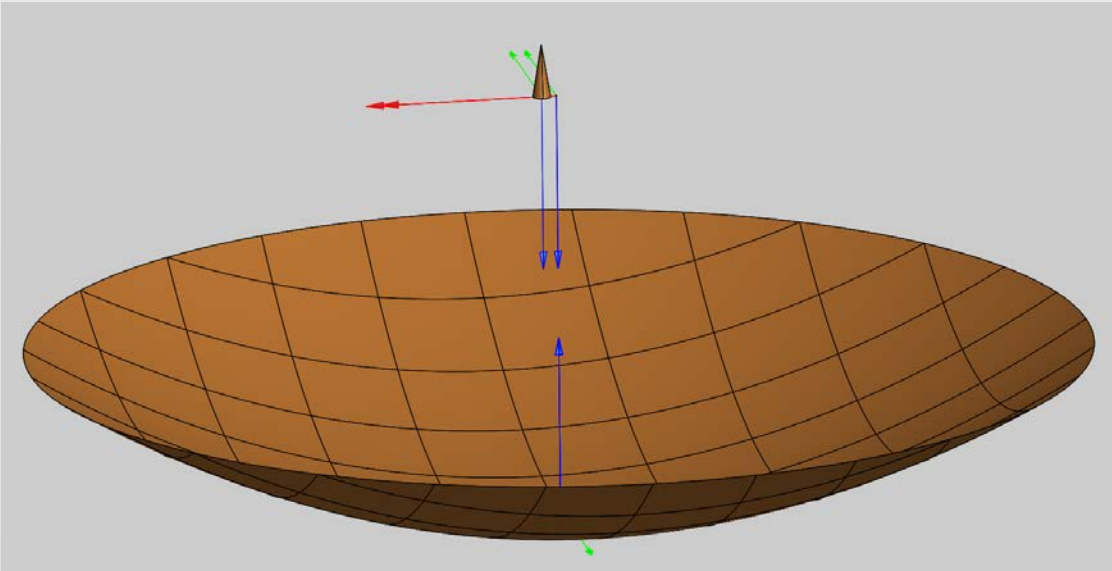


Offset feeds on prime-focus antenna

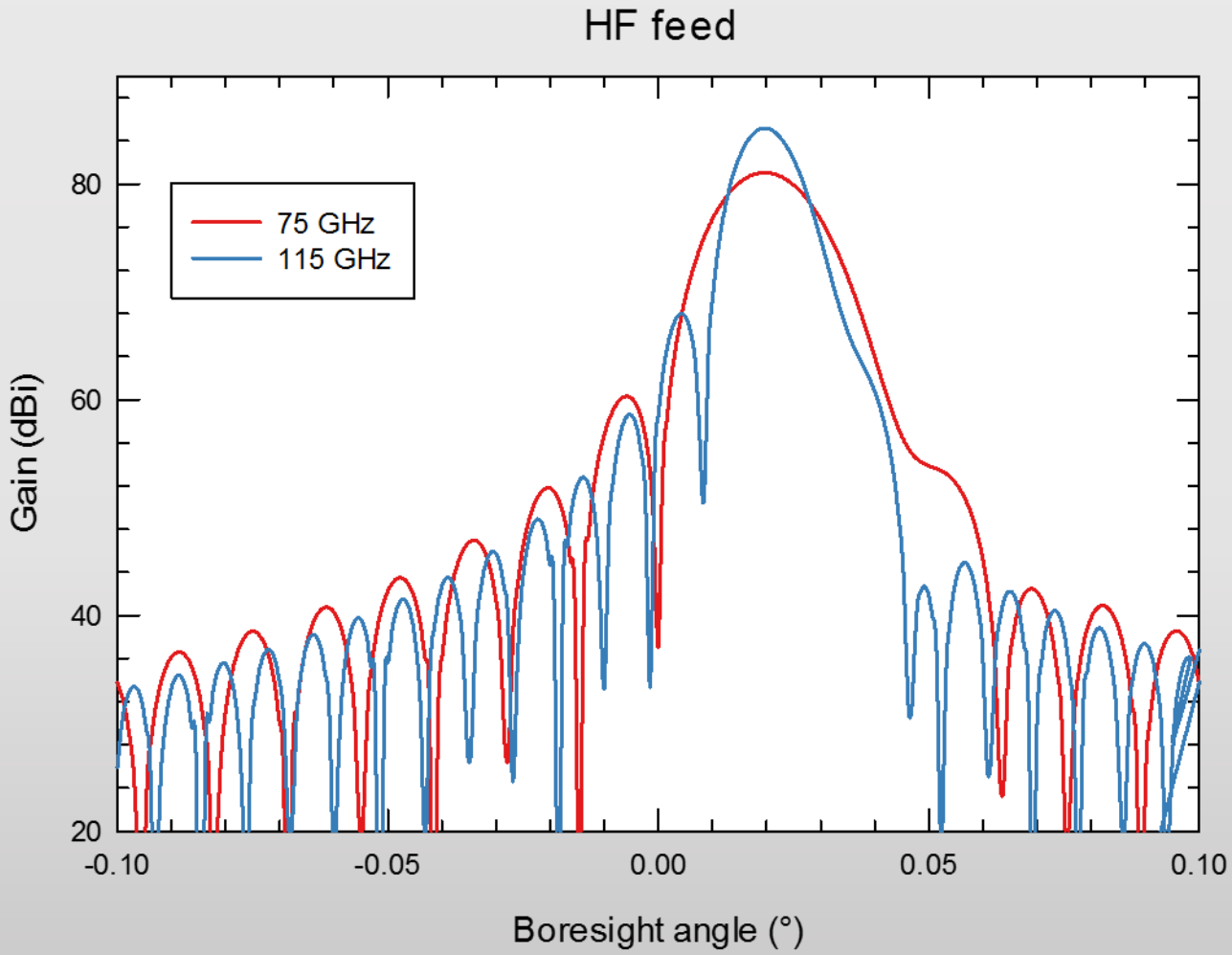




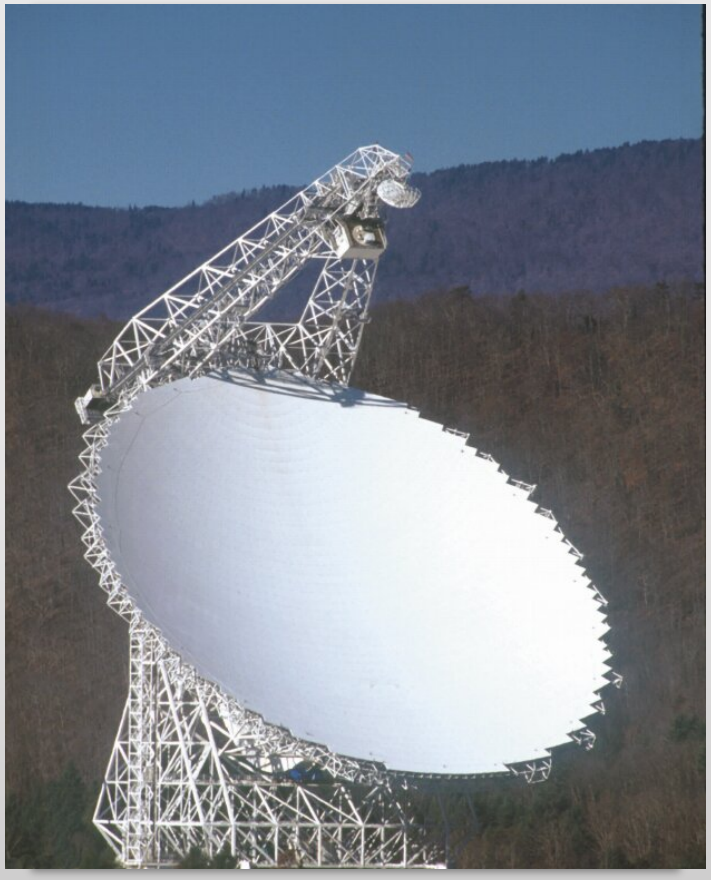
Offset feeds on prime-focus antenna

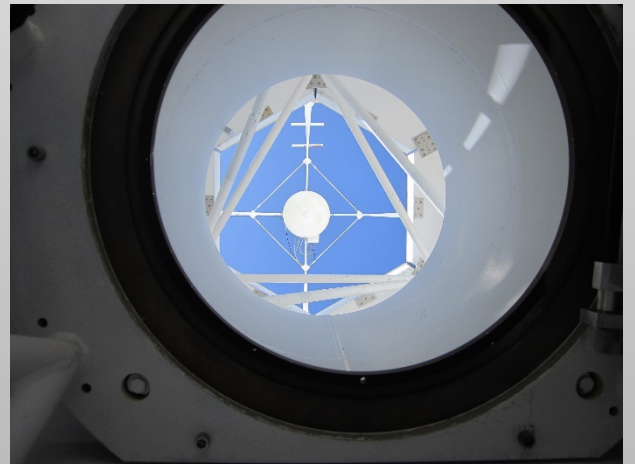


Freq (GHz)	Rel. Eff.
70	0.97
115	0.93



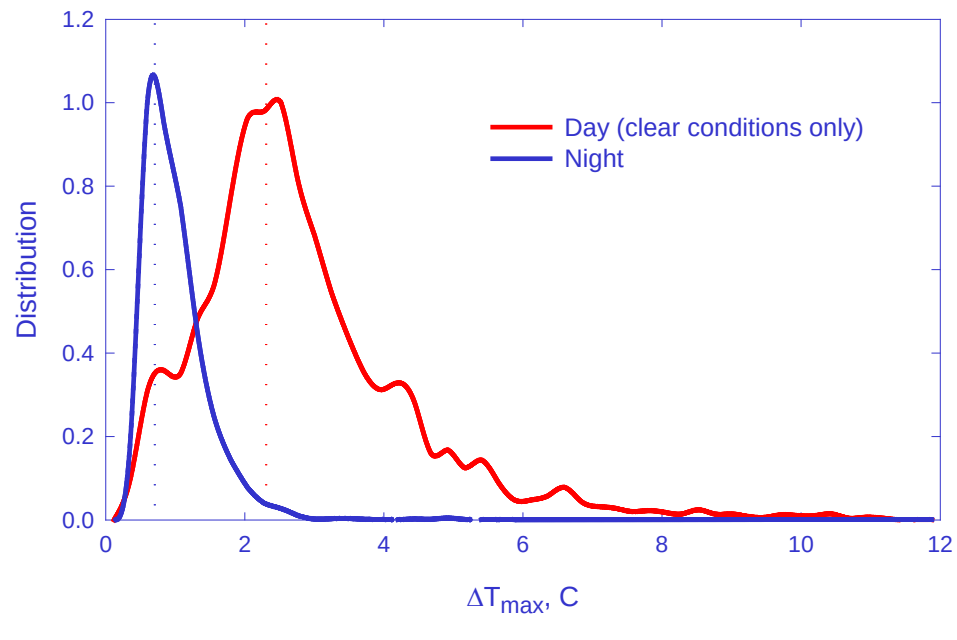
Offset vs symmetric

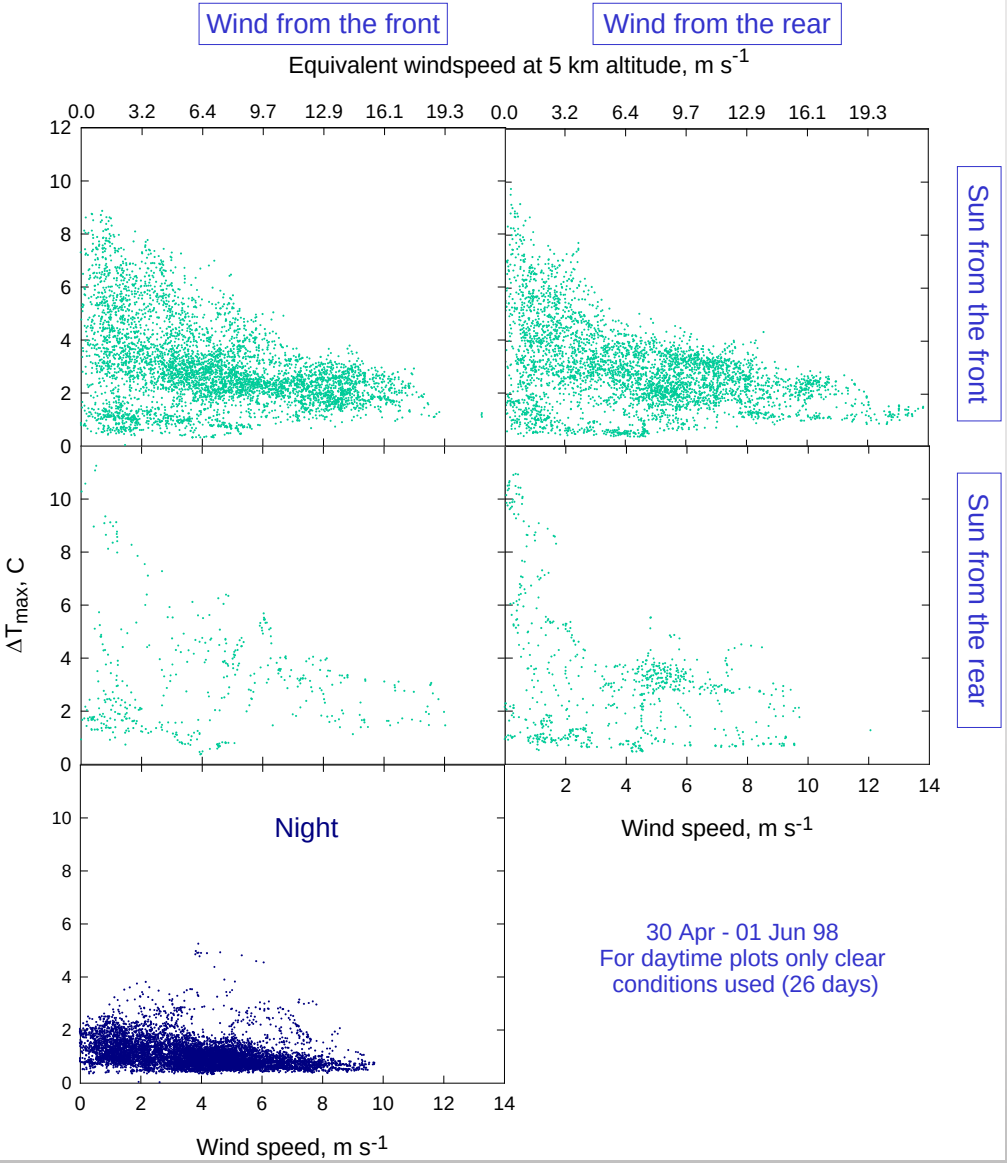




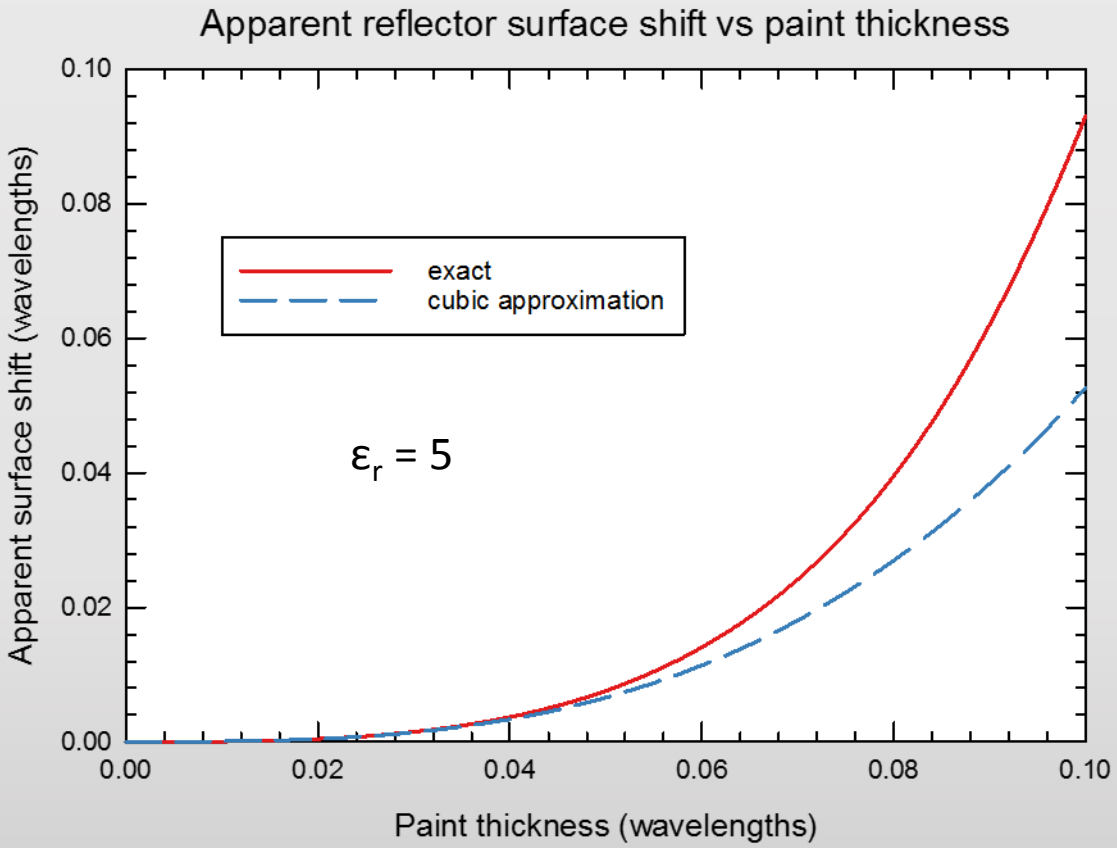
Thermal control

Expected temperature differentials; Effect of wind





Reflector surface protection (thermal/corrosion/solar diffusion)

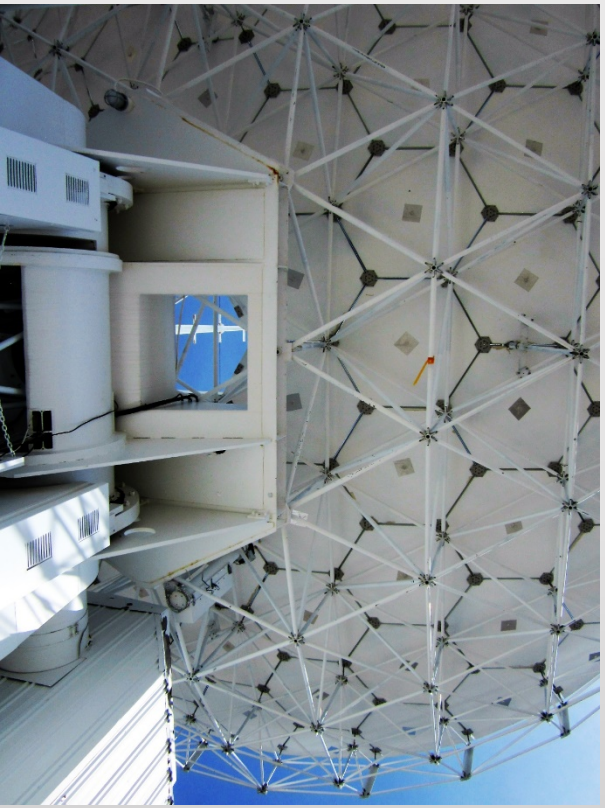


50 µm at λ2.7mm is <0.02

Optical configuration

Backing structure

Surface



Mount axes

Reconfigurability