Designing experiments at Arecibo

Today's exercise

We have access to the Arecibo radar from about 18:30 – 07:30 LT

Each group should :

- Discuss and decide on a science topic you want to study with Arecibo.
- Decide on the what mode to run to accomplish your science goals and when to run it.
- Write a request for radar time, fill in the form and send it to Elizabeth
- Get the request approved by Elizabeth
- Get ready to be awake and ready to run your experiment at the time assigned to you

Arecibo Observatory Telescope Schedule

July 16 - July 30, 2017

TRANSMITTERS

2380 | 430 | HF

Opt | 47 | System Checks

VISITORS
(or PIs)
V. Kaspi
E. Fonseca
L. Spitler
K. Stovall
A. Jaodand
R. Hinchin
V. Kaspi
A. Seymour
K. Jones
S. Clark
C. Heiles
T. Cromartie
J. van Leuuwen
R. Hinchin
J. Rankin
H. Geha
J. Hessels
E. Kendall
C. Salter
T. Ghosh
J. Hartinez

COMMENSAL PROJECTS:
P2030: A2754, A2757
ALFA Rx: A2774

VER 5.0 - 18Jul17

AST	16 SUN	17 MON	18 TUE	19 WED	20 THU	21 FRI	22 SAT	23 SUN	24 MON	25 TUE	26 WED	27 THU	28 FRI	29 SAT	30 SUN	LST
2	P2030	P2030 vk	P2680 X102 pp	P2030 vk	P2030	P2030	P2030 vk	P2780 pd/dn (a)	P2780 pd/dn	H3207 HF	T3196 ek	T1193 en	H3207	H3207	H3213 en	
	P2945	P3114		P3114	P3114	V3003 RA	P2945			H3156			H3156	kj	en	
4	P2945 X111	A3174 kj	- - -	- - -	P1693 jd	A3126	P2945 X111	X111 - - -	"(b)"	H3207	- - -	- - -	H3207 - - -	- - -	- - -	0
6	P2945 P1693 jd	A3172 sc (a)		A3172 sc (a)	A3172 sc (a)	A3118 X111	P2945 P1693	A3172 sc (a)	X111 P1693	kj (DB)	ISR SSch (DB)	(DB)	kj			
8	P3182	MAINT	MAINT	MAINT	X114	X114	P2822	X111 P2780 pd/dn	X114 elec	H3206 cf	H3206 cf	H3206 cf	HF Camp (DB)	HF Camp (DB)	(DB)	
10	P3054 ls	f/e	e/f	f/e	X110 elec	X110 elec	P3185 jr (b)	(d)		X114	X114	X114	X114	X114	X114	
12	P2825 X111 to						X111	P1693 jm	H3206 cf	H3195	H3211	H3211	H3195 vs	H3213 en	H3213 en	
14	P2905				X114	X114	P2825	P2905	H3156 T2567 "hc"	H3195 vs - - -	H3211	H3211	H3156	(DB)	(DB)	12
16	A3123	- - -	- - -	- - -	X114	X114	P2780 - - -	P3169 jh			H3206	H3108 fd	H3195 vs	H3199 ak	H3199 ak	
18	X111	P1693 jd	X113 X111 to	A3119 ch	X111 P3185 jr	X111	pd/dn	(c)	(DB)	T3196 ek	T1193					
20	P3183	A3172 sc (f)	P2945	P1693 jd	(c)	A3172 sc (f)	NANO	P2945 ef	T2567 hc fd	ISR SSch	T1193 en	H3108 fd hc	H3207 kj	H3213 en	H3213 en	
22	X111 A3123	P3132	P2945 A3069 -rm-	P3181 rf - - -	A3069 P2030	P3169 jh - - -	Grav (a)	P2780 pd/dn "(b)"	(DB)	(DB)	(DB)	(DB)	(DB)	(DB)	(DB)	19
24	P2825	P2680														

2017 ISR Summer School
Incoherent Scatter Radar Experiment Request
Arecibo Observatory

To design your experiment, choose the desired options from each category.

Transmitting modes:

There are many data-taking modes at Arecibo. All modes are optimized to take full advantage of the sensitivity. The ones below guarantee fast processing. Note: Coded Long Pulse (CLP) is designed for altitudes as high as 600 km. Topside is used for higher altitudes. (Check one or both)

- ☐ Coded Long Pulse (CLP)
- ☐ Topside

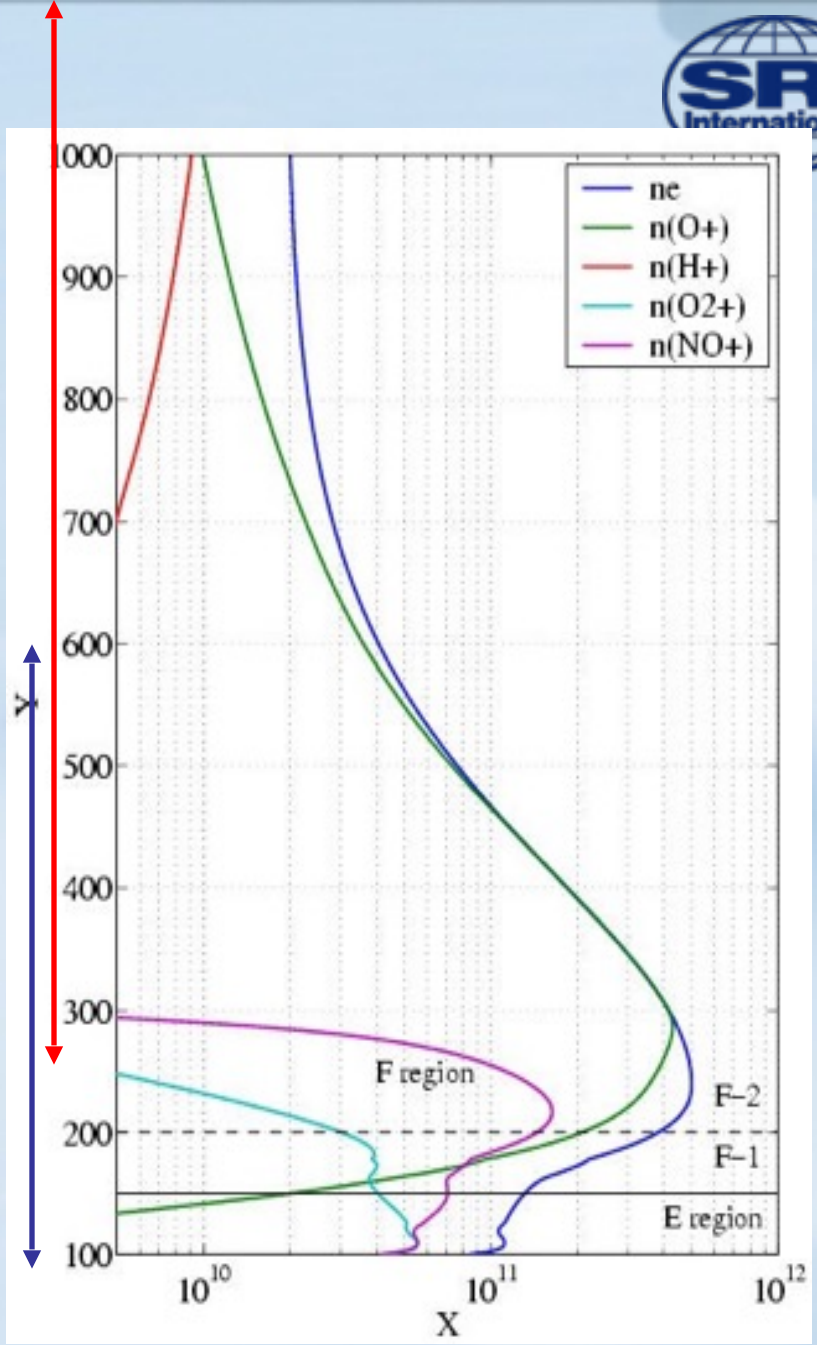
Experiment specifics:

Two different pulse schemes will be used:

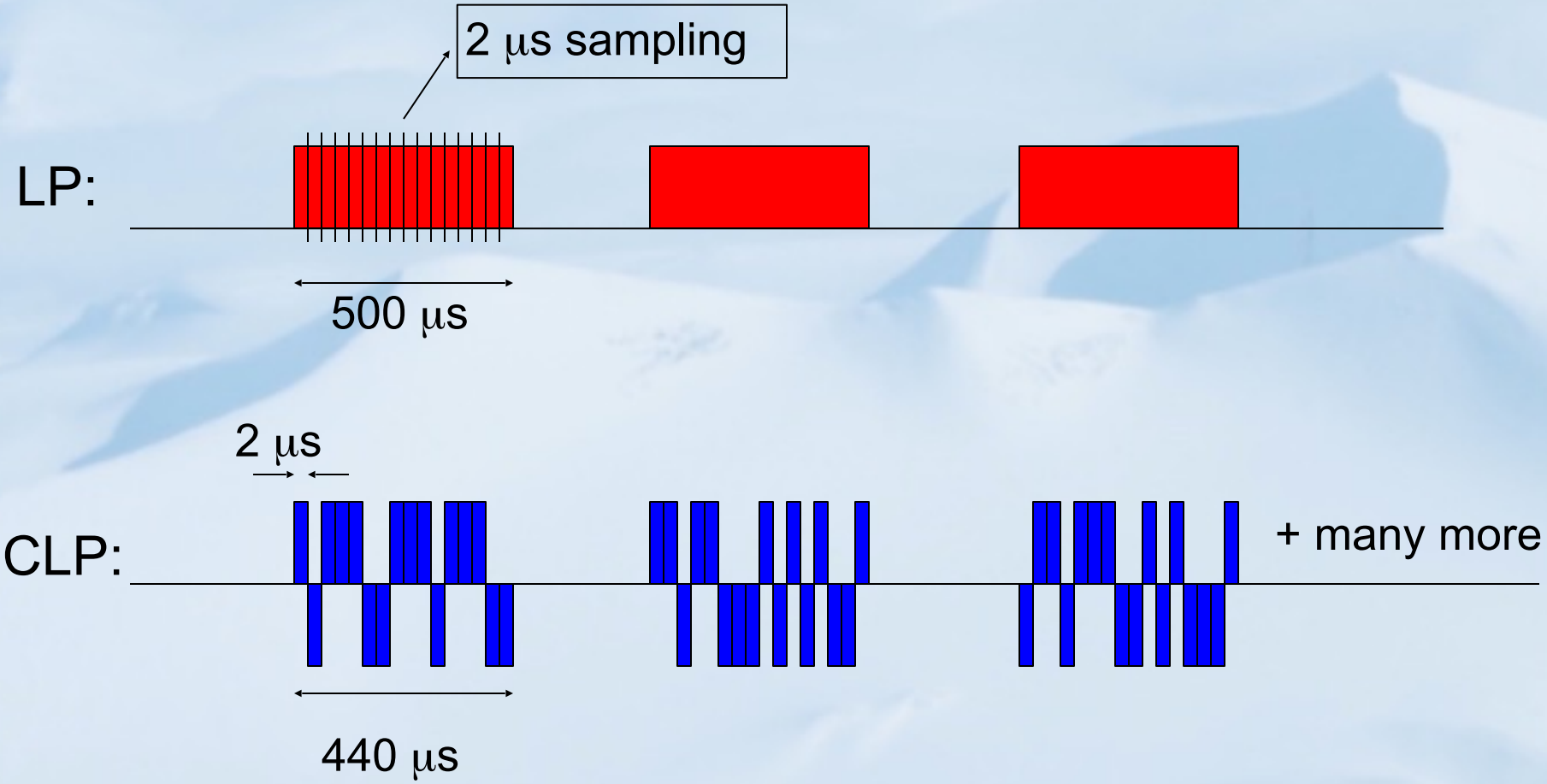
Topside - LP-(500μs) resulting in 38 (75) km resolution data between ~250-4000 (2600) km

Coded long pulse- CLP - (2μs baud) resulting in 300 m resolution between ~90-600 km

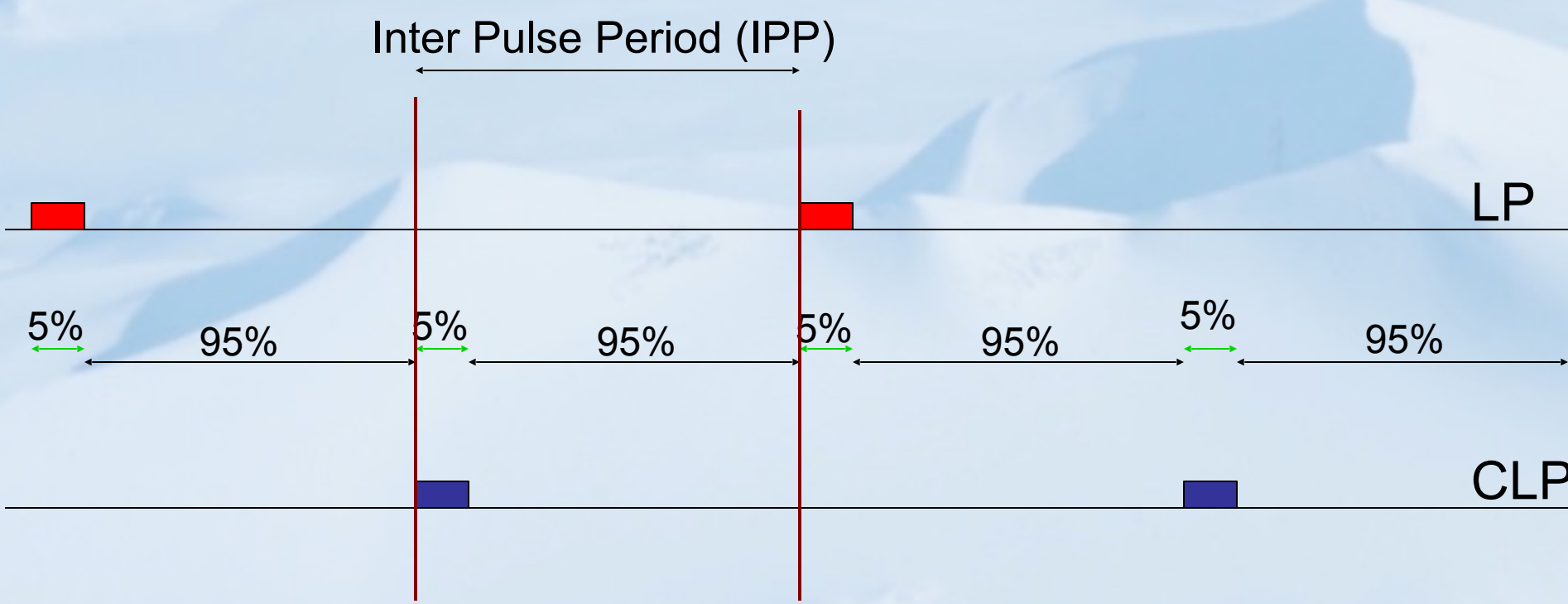
About 5% duty cycle



Cartoon of LP and AC



What 5% duty cycle means…

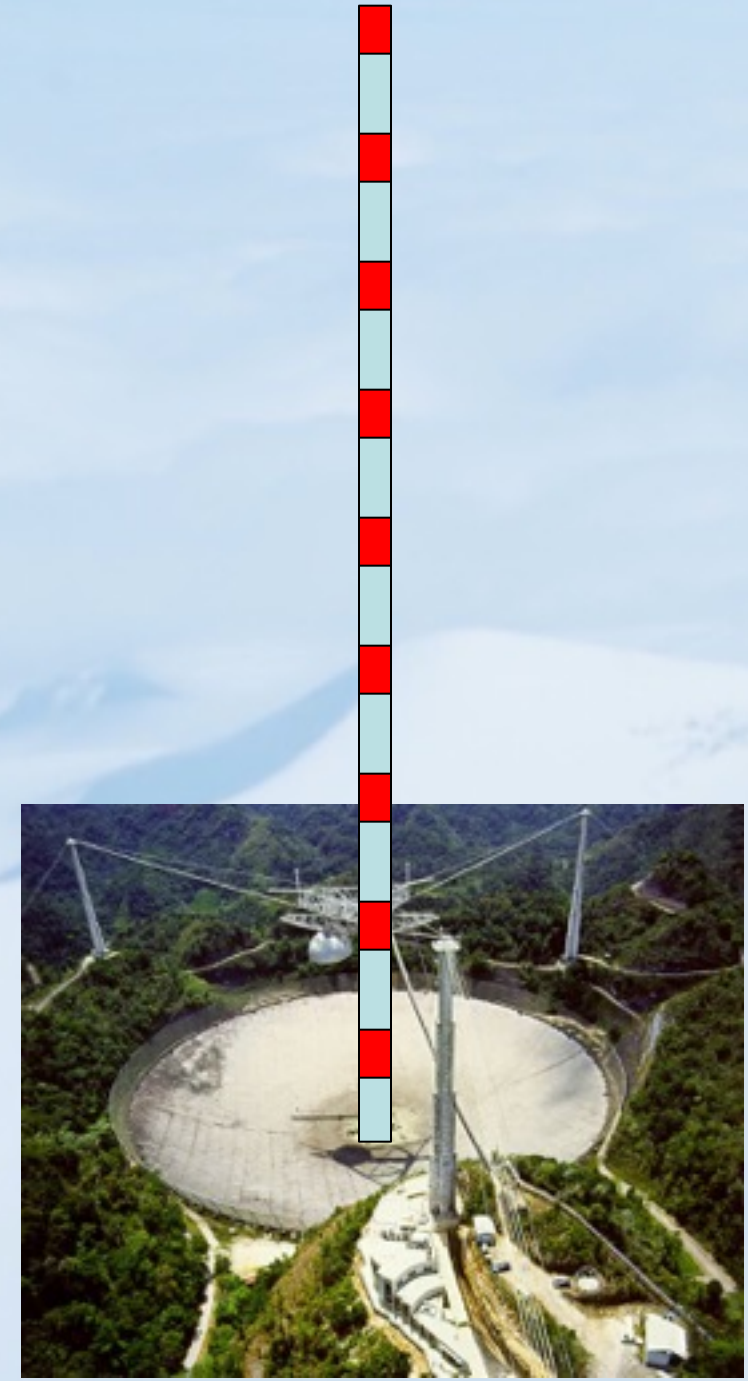


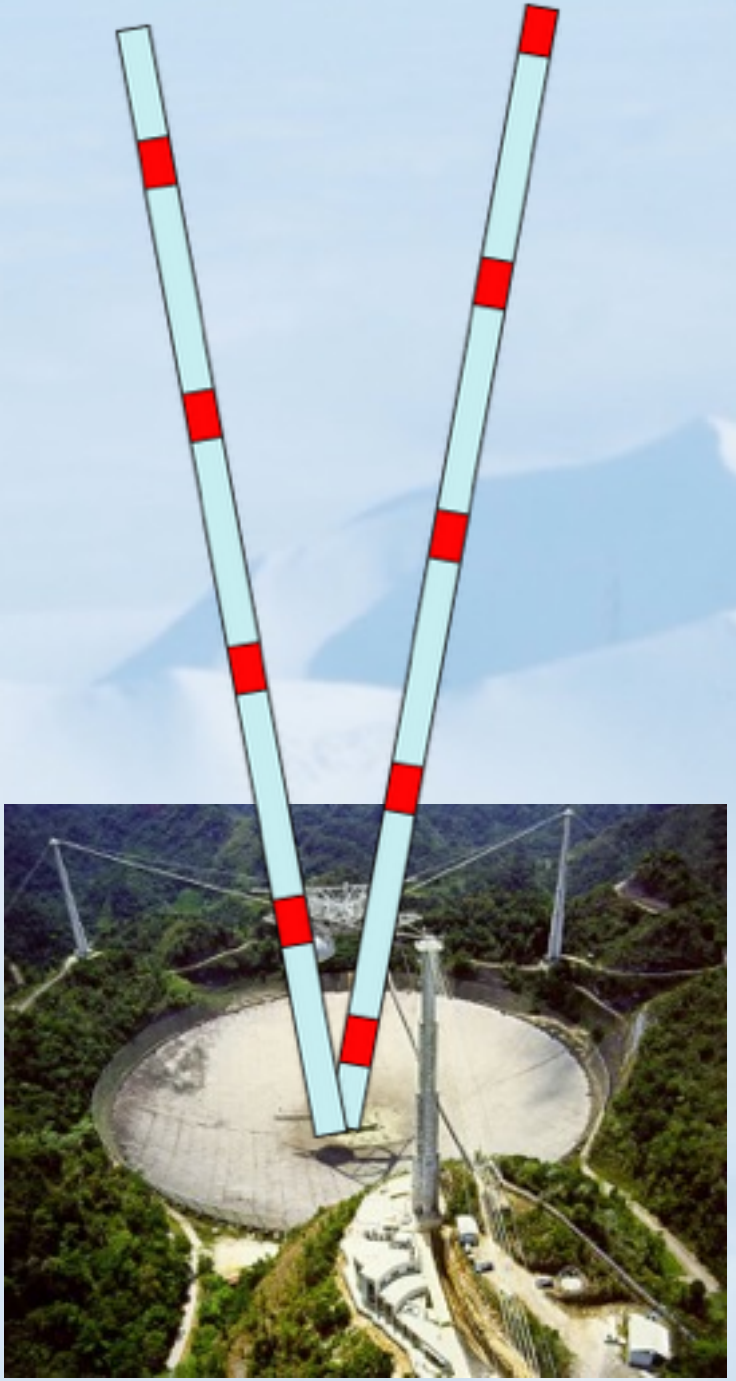
In the 95% of “non-transmitting” we do sample the signal, noise and calibration.

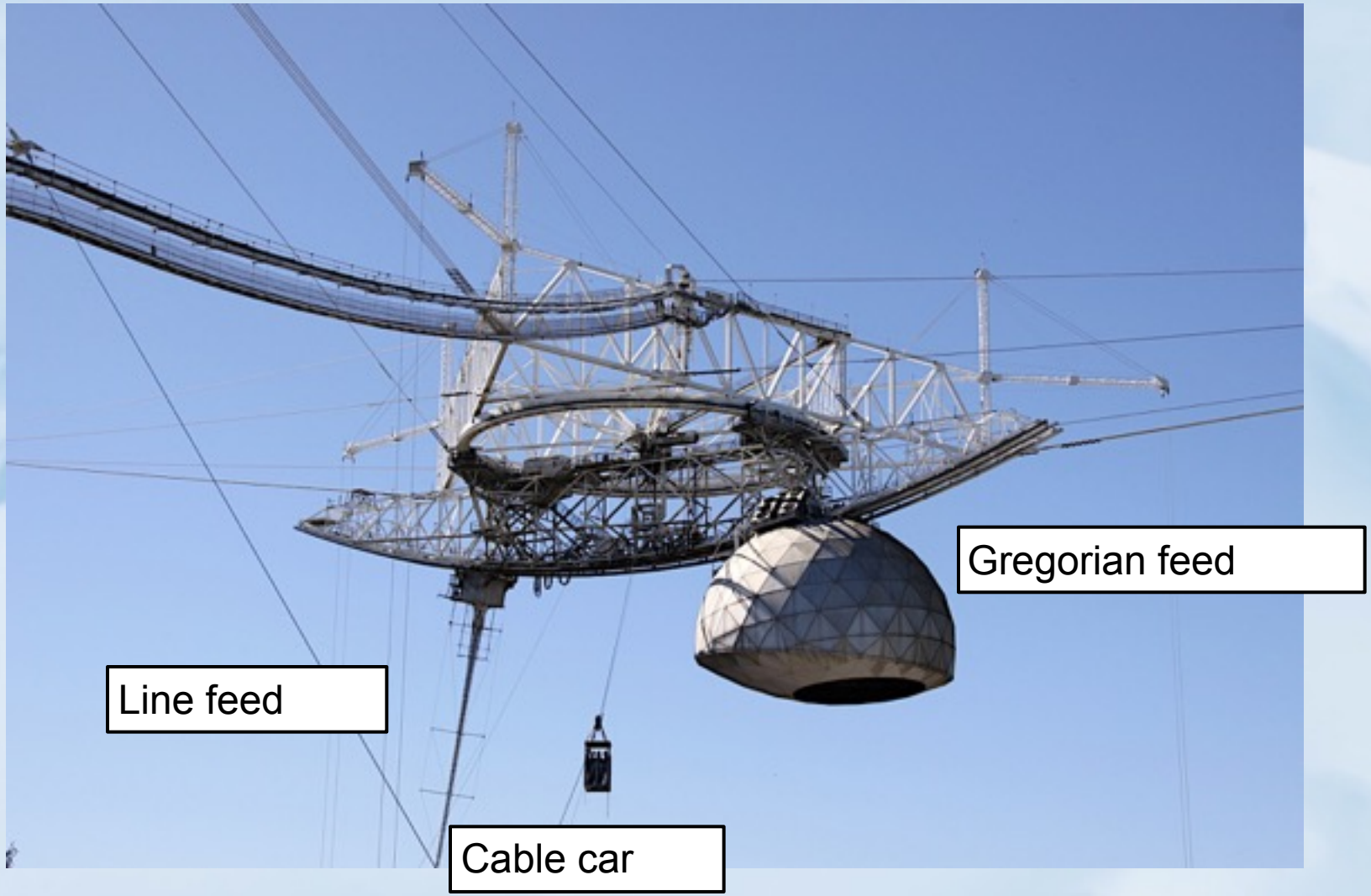
ISR Receivers

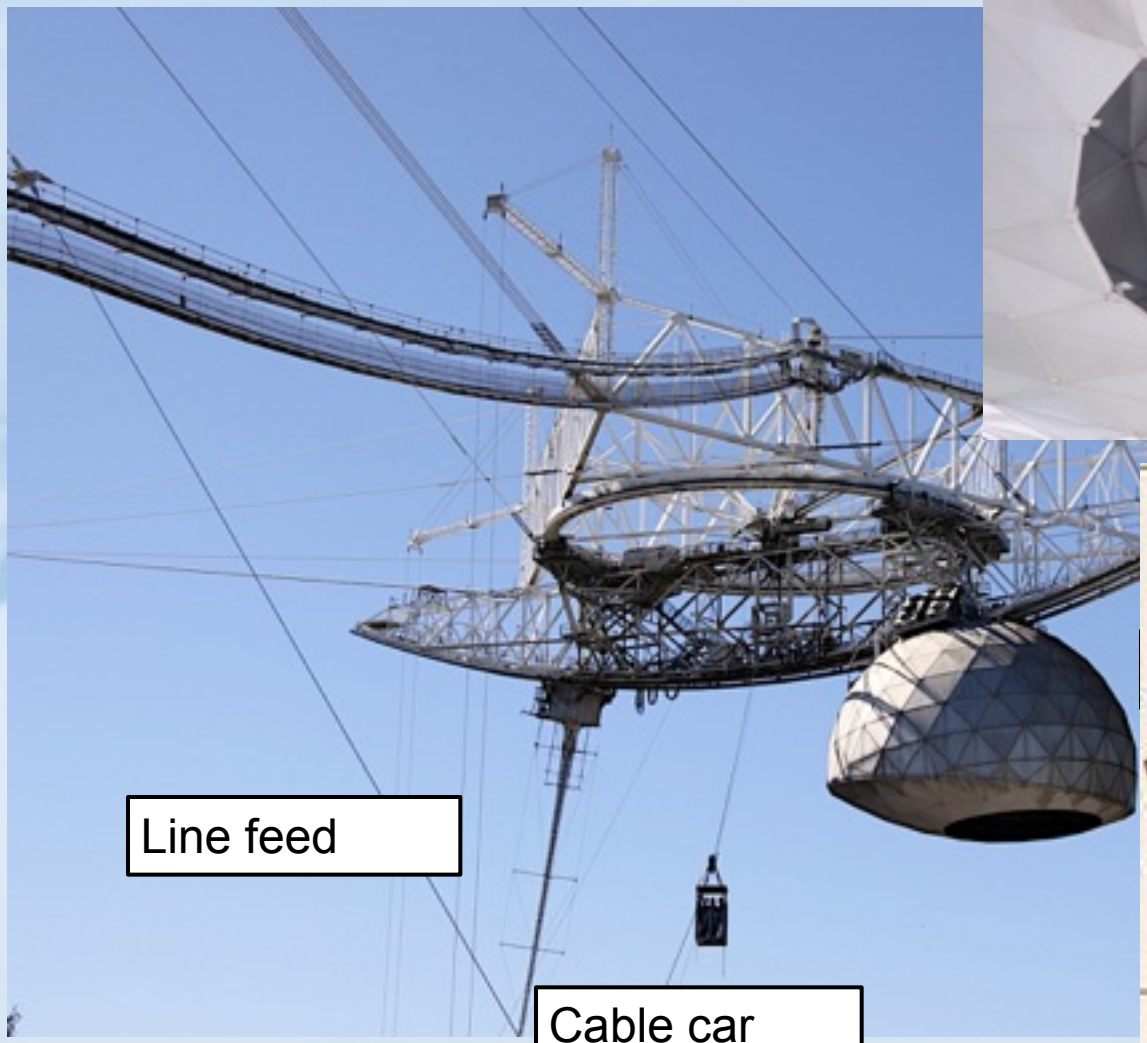
Note: If you choose two feeds ("Double Beam") the power is split between the beams and the sensitivity is reduced but an extra set of data is collected.

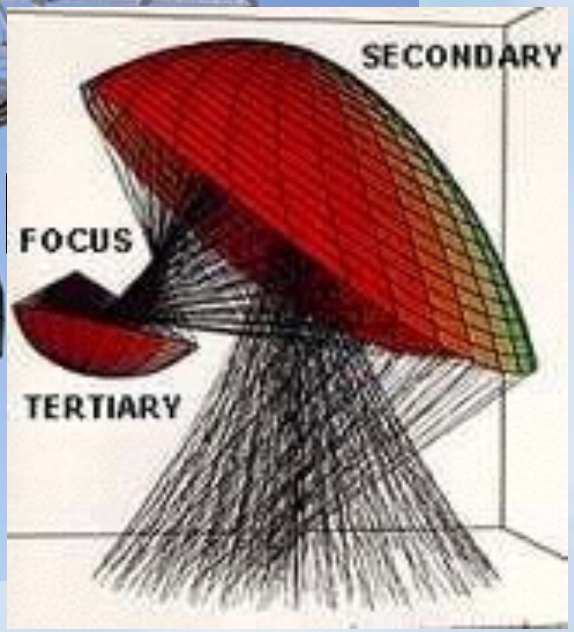
- ☐ Gregorian
- ☐ Line feed



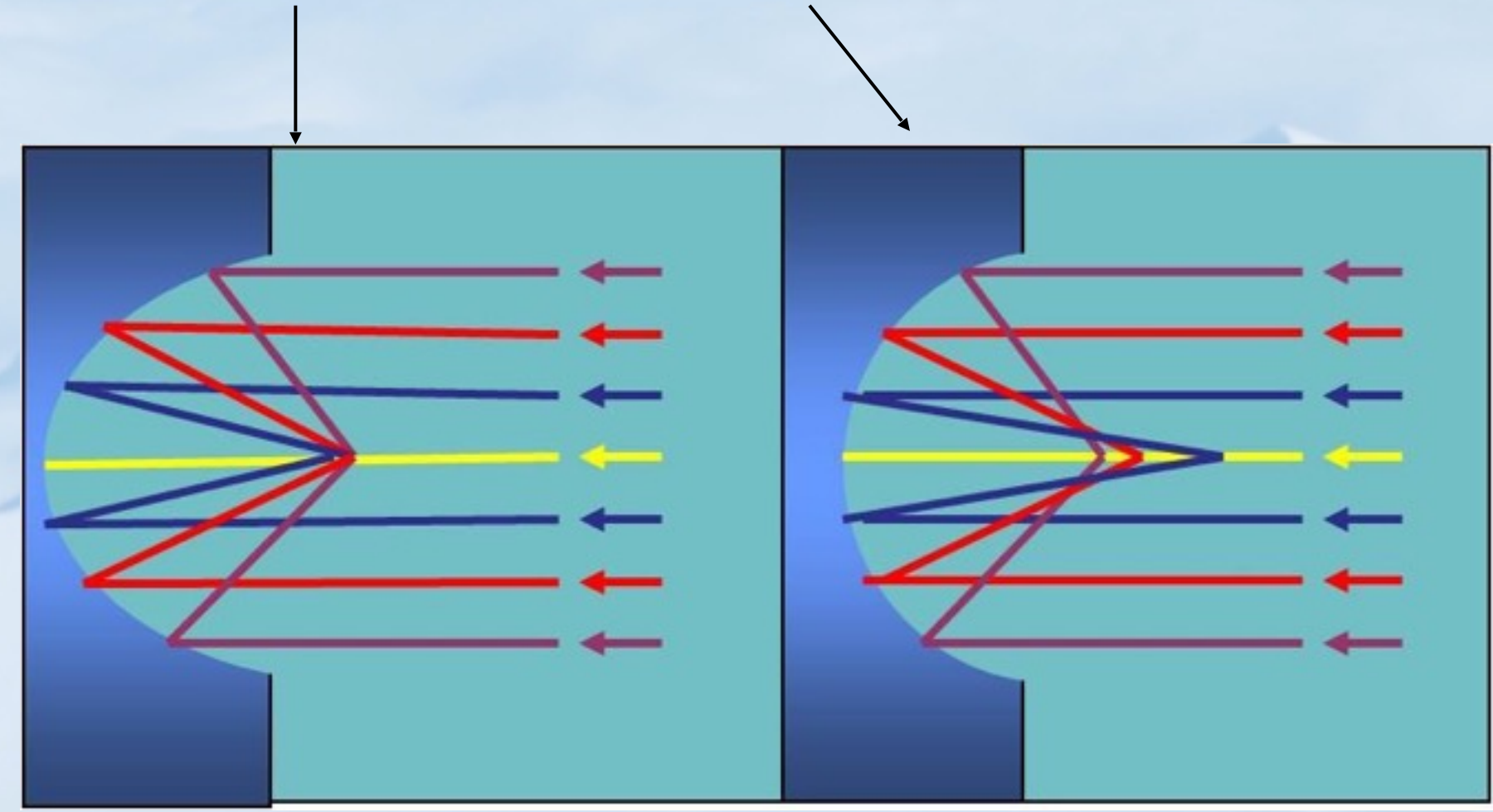



Gregorian feed
Line feed
Cable car

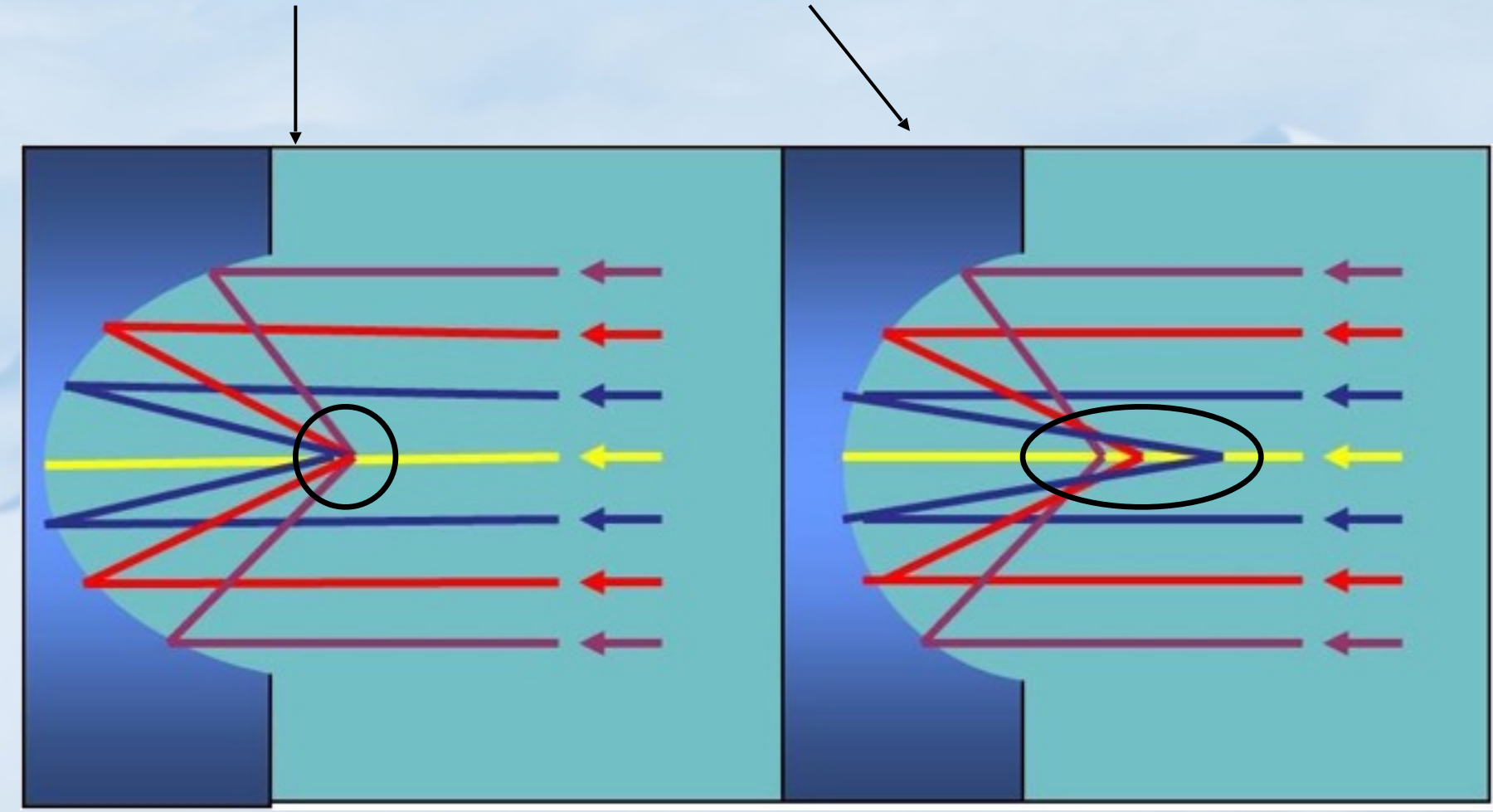

Line feed
Cable car


SECONDARY
FOCUS
TERTIARY

Parabolic versus spherical antennas



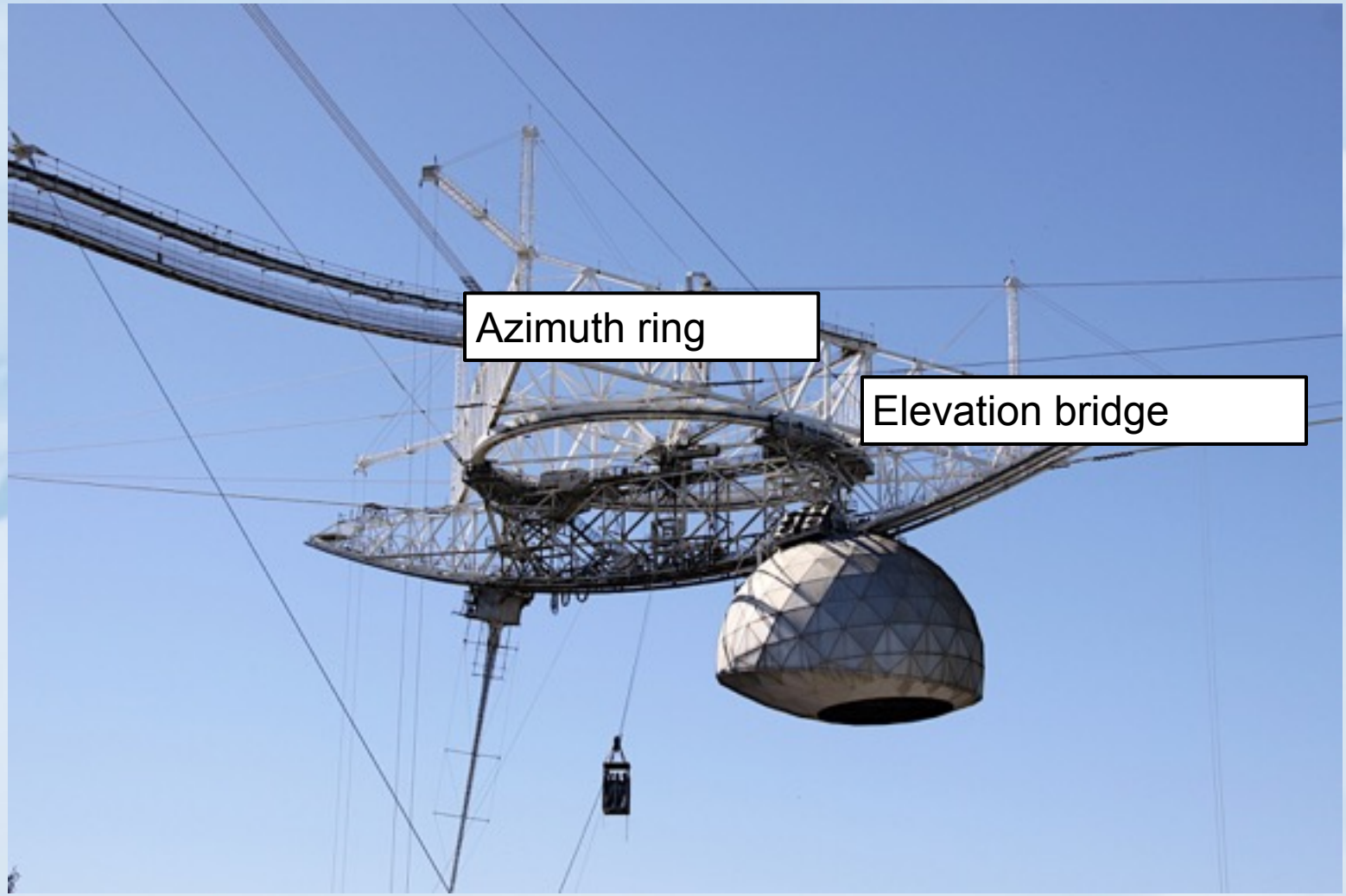
Parabolic versus spherical antennas



Ponting direction

An example: Use the Gregorian at vertical (range = height) and Line Feed at 15 degrees from zenith (to sample a different volume than the Gregorian) and azimuth at magnetic north (guarantees that the line feed is looking to the magnetic line). The values for this configuration are (348, 0, 15).
Provide three values:

1. _____: Azimuth direction (If rotating, leave blank and specify azimuth rotation below)
2. _____: Gregorian inclination (degrees from zenith)
3. _____: Line Feed inclination (degrees from zenith)


Azimuth ring
Elevation bridge

Azimuth rotation

Azimuth rotation entails moving the platform. To rotate the azimuth, select the initial and final position of the rotation in degrees. The range of values are 0 to 720 degrees.. The platform will rotate between these values and then return to the starting value with a velocity equivalent to 360 degrees/15 min. One common example is to leave the Gregorian vertical and rotate the Line Feed from 0 to 360 degrees. This configuration is used to estimate vertical winds with the Gregorian and then estimate the other two components with the scanning Line Feed.

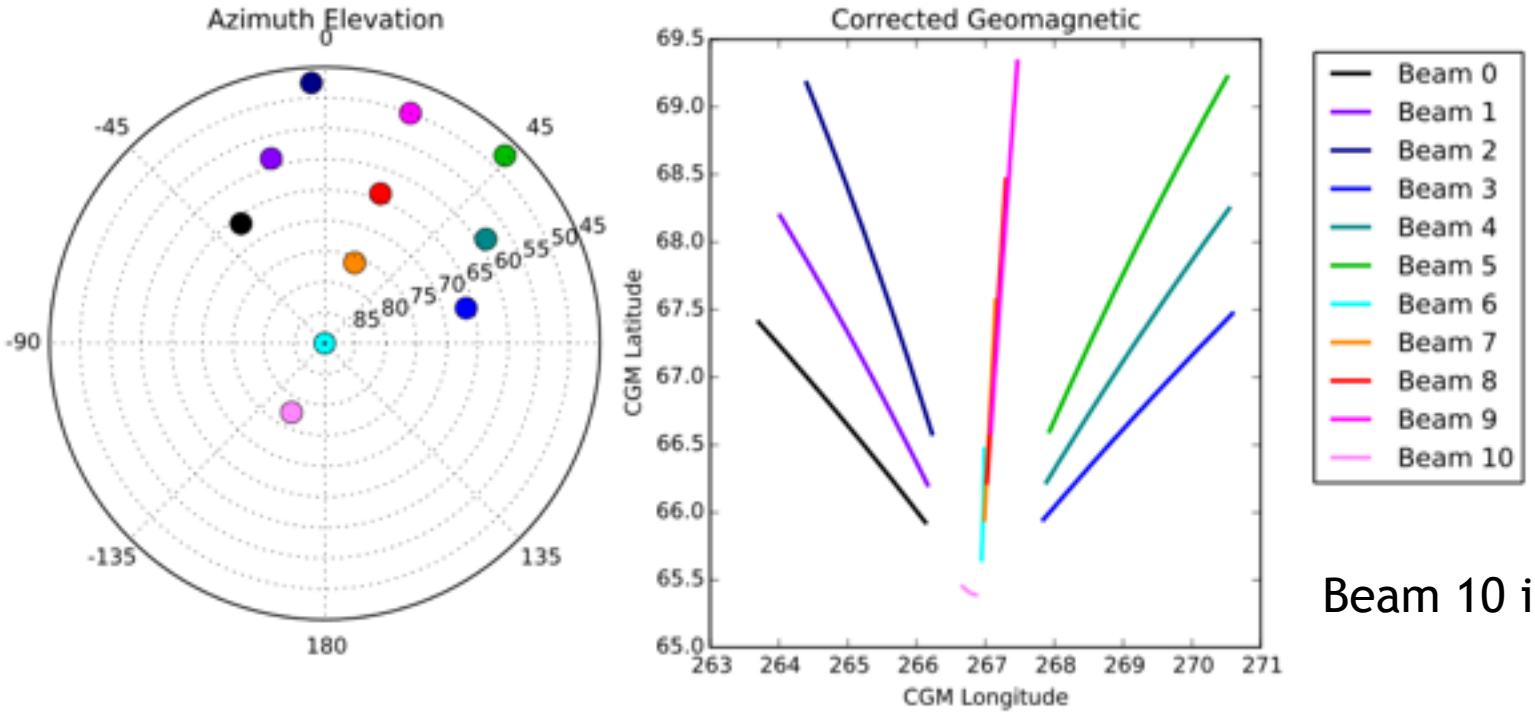
☐ Yes _____: Initial position _____: Final position

☐ No

By 18:00 today

- Decide on a science topic
- Decide the right experiment to run in order to study it (choices described on the form)
- Decide which two hours to run it (18:30 – 07:30)
- Fill in the form
- Send
  - Short description of your science topic and preferred time
  - Give Elizabeth (or another lecture) the form or email Elizabeth your selections
- Elizabeth.kendall@sri.com

PFISR WorldDay40 Mode



Beam 10 is Up-B

Transmissions:

•E-region (449.6 MHz): 480 μs 16-baud alternating code (30 μs = 4.5 km resolution)

•F=region (449.9 MHz): 330 μs uncoded long pulse. Two long pulses for every alternating code for better F-region statistics.

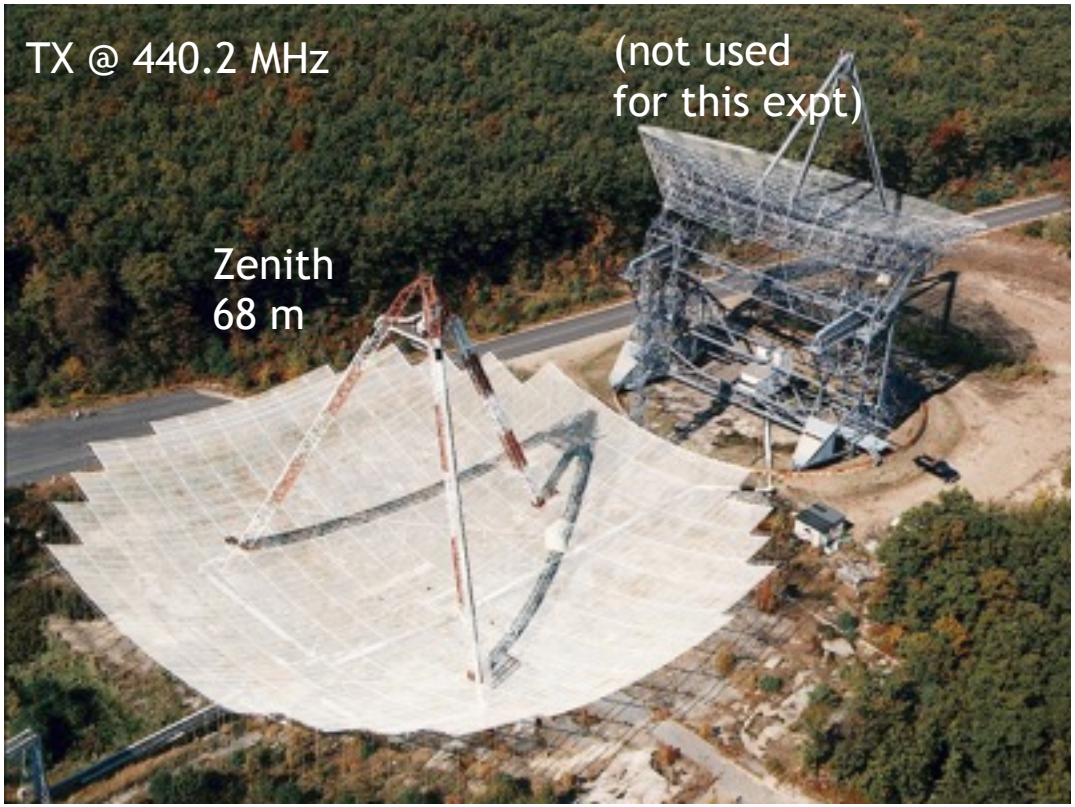
Receiver Data Taking Computers (DTC):

•DTC 0: 10 μs oversampling of alternating code on 449.6 MHz (E-region Ion Line)

•DTC 3: 20 μs oversampling of long pulse on 449.9 MHz (F-region Ion Line)

•DTC 1: 0.28 μs oversampling of long pulse on 444.9 MHz (Downshifted Plasma

Millstone Hill ISR Mode: Zenith Profiler
2017-07-25 2000 to 2017-07-26 2000 UTC



This experiment uses both alternating code and single pulse waveforms to make zenith only measurements. An interleaved single pulse - alternating code waveform gives E and F region coverage. The experiment is aimed at determining ionospheric storm response, traveling ionospheric disturbances, and mid latitude plasma structuring. This is a zenith pointing only experiment.

Repeats:

Zenith: 480 usec alternating code / uncoded pulse: 4 minutes [E, F region]

Plasma line information available as well as ion line fits

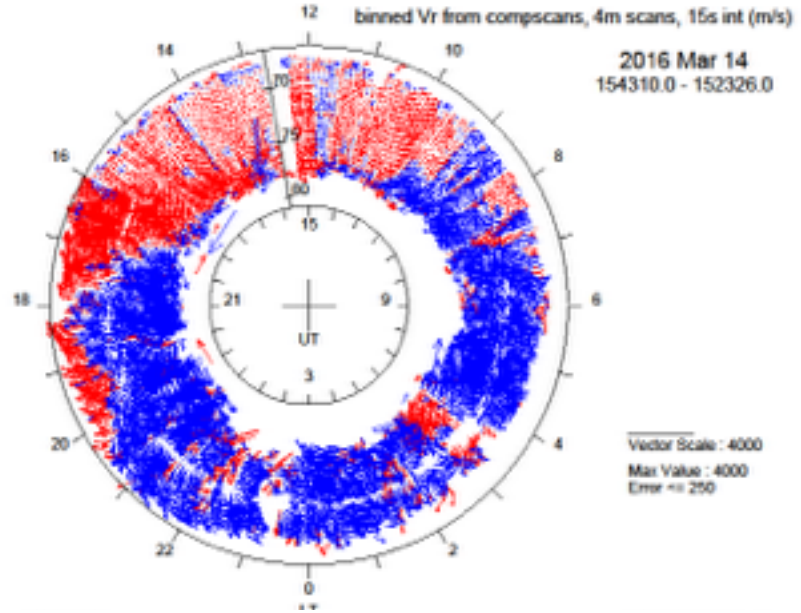
Sondrestrom ISR, Greenland

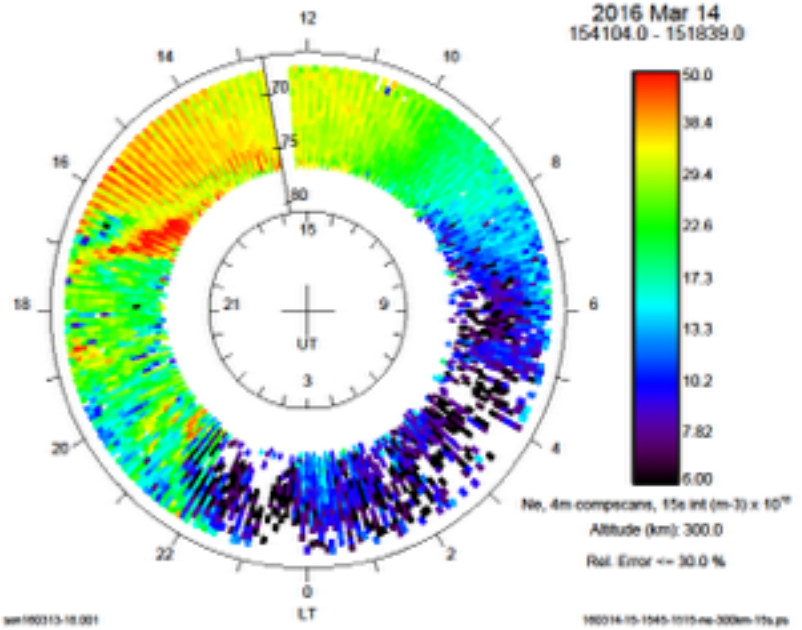
- Scan east and west of the magnetic meridian
- Dual long pulse plus Barker code
- 4.5 minute, 48 km range resolution
- Good F-region coverage
- Measures ion velocities over about 10 degrees of latitude.

Sondrestrom

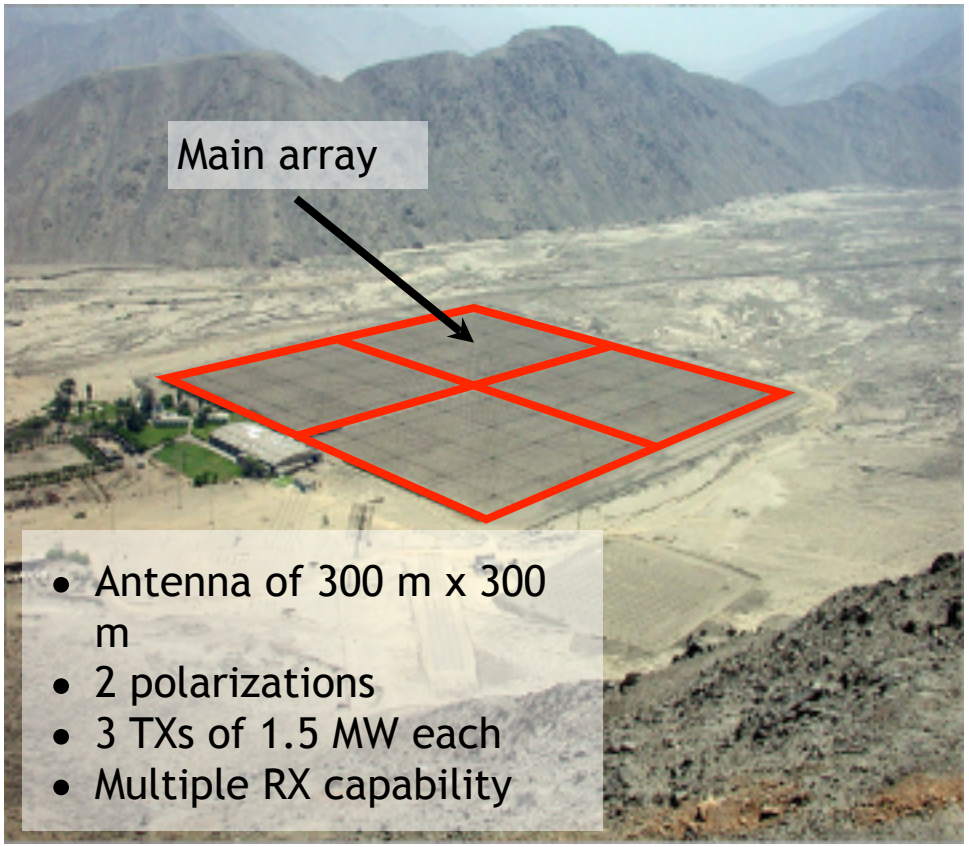
Geographic coord.	66° 59'12" N 309° 03'02" E
Geomag. dip angle	80° 24'
Invariant latitude	74° 11'24" N
Local time	UT – 3 (UT – 2 summer)
Magnetic time	UT – 1:58
Elevation	177 m
Coverage	360° az., above 25°–30° elev.*

*Dependent on azimuth. No transmission below this elevation.





Jicamarca Radio Observatory
Combo ISR mode: EW-Drifts + Faraday



- Three beam pointing directions:
  - West and East (perp-to-B)
  - South (off perp-to-B)
- Six antenna channels, two per each pointing direction.
- 1 polarization diversity (south)
- 2 spatial diversities (west and east)
- We can measure:
  - Vertical and zonal drifts
  - Electron densities
  - Electron and Ion temperatures

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