Antennas and Transmitters

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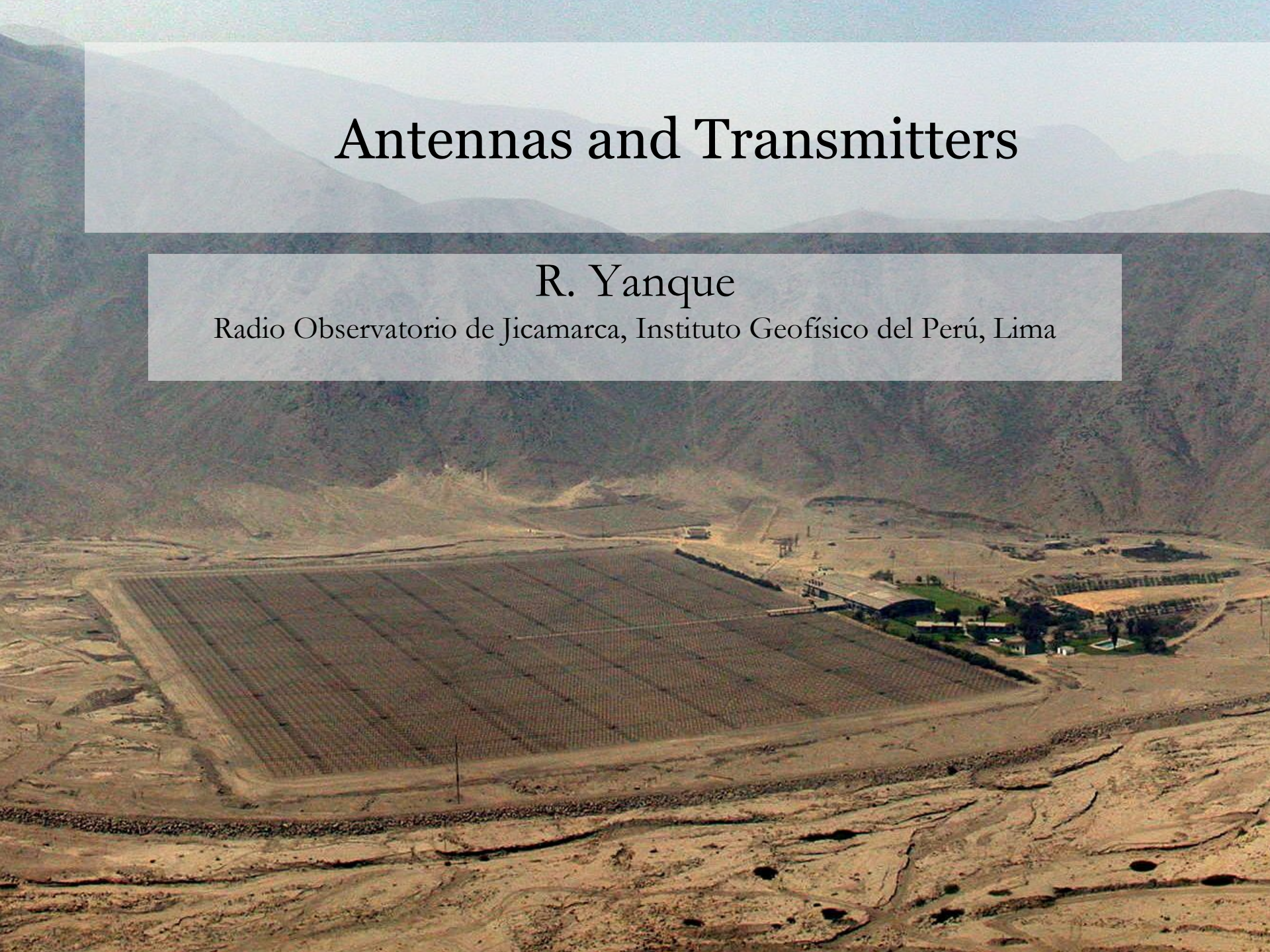


Contents

- Jicamarca Antennas
  - **Main Antenna**
  - Useful Programs
- JASMET Antennas
- Jicamarca TX
  - Low Power Transmission
  - High Power Transmission

JRO Antennas

Main

Bistatic Tx

AMISR-14

Yagi array

SOUSY

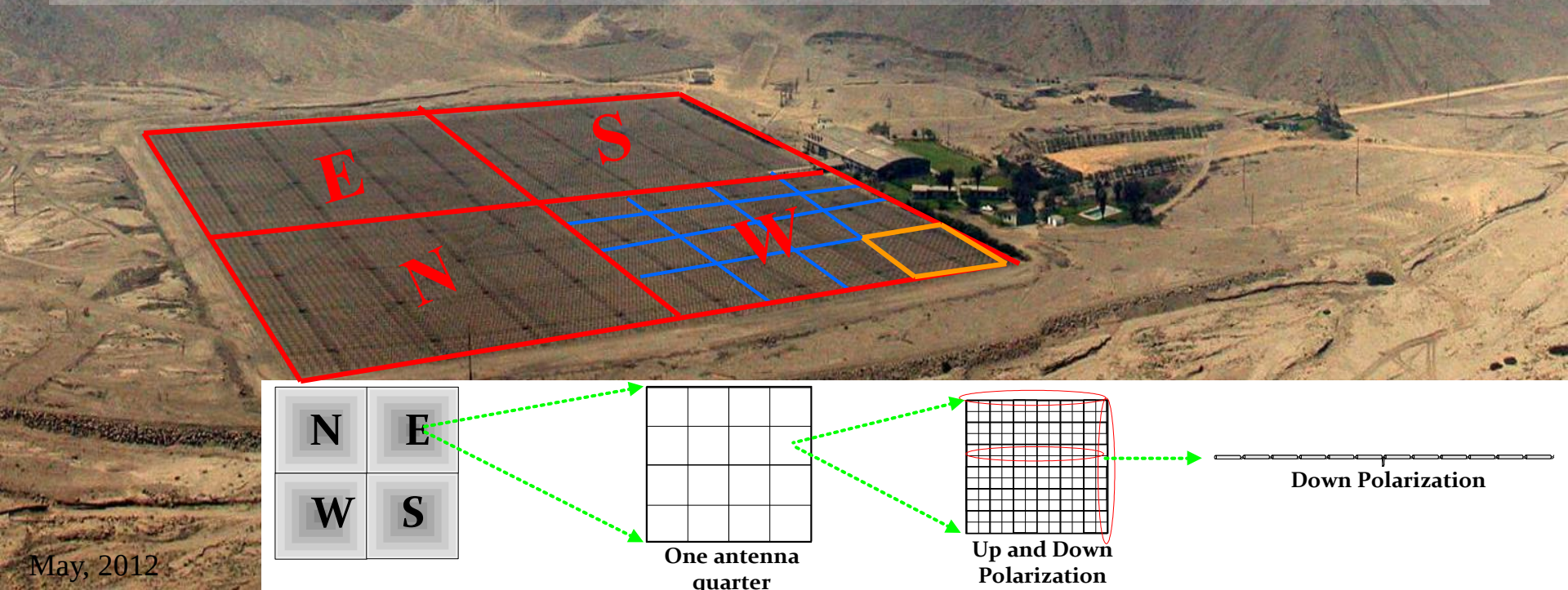
Digisonde Tx

Mattresses

COCO-100

Jicamarca Antenna and Connections

- 64 cross-polarized module (x or down, and y or up), arranged in four quarters.
- Each module consist of 12x12 half-wavelength dipoles (18432!)
- Each quarter is fed independently.



Jicamarca Antenna Pattern

Important parameters (see Ochs, 1965)

- Separation (in m)
  - Dipoles: 3 m
  - Modules: 36 m (12 dipoles)
  - Quarters: : 147 m (4 modules +3 m gap)

Phasing is done at the module and quarter level

•Frequent module cables:

–Standard (32 sets for 2, 3, 4 and 5 m cables), Fritts's cables (specially to point symmetrically in four beam directions), yellow cables

–ABS(Antenna Beam Switching)

Manual Beam Switching

Automatic Beam Switching

Jicamarca Antenna Pattern

- The total pattern is the product of:
  - Dipole pattern (known analytical function)
  - Module pattern (known analytical function ~sin(nx/2)/sin(x/2)
  - Quarter pattern (known analytical function for some phases)
  - All quarter pattern (known analytical function for some phases)
  - Ground pattern (know function of separation)
- Estimation of a general 2D pattern

$$E(\theta_x, \theta_y) = \sum_i g_i e^{j\frac{2\pi}{\lambda}(x_i\theta_x + y_i\theta_y) + j\phi_i}$$

where g_i is the gain of each element (usually 1),

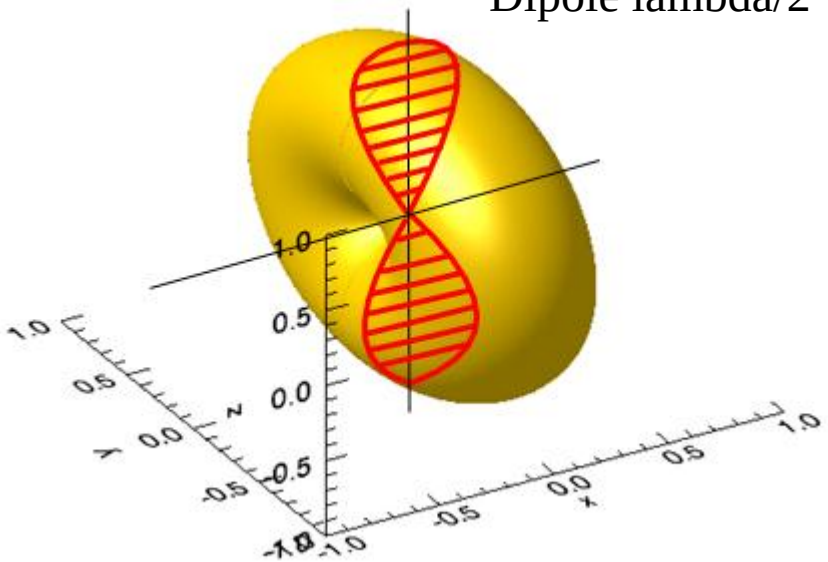
ϕ_i is the phase delay due to the cables in radians,

(x_i, y_i) is the module position in meters

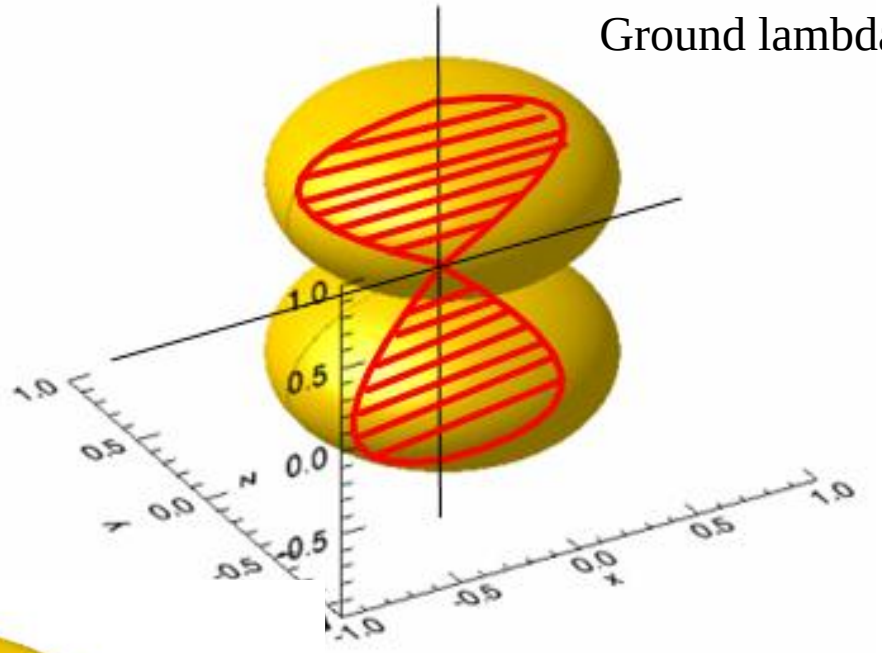
(θ_x, θ_y) the direction cosines

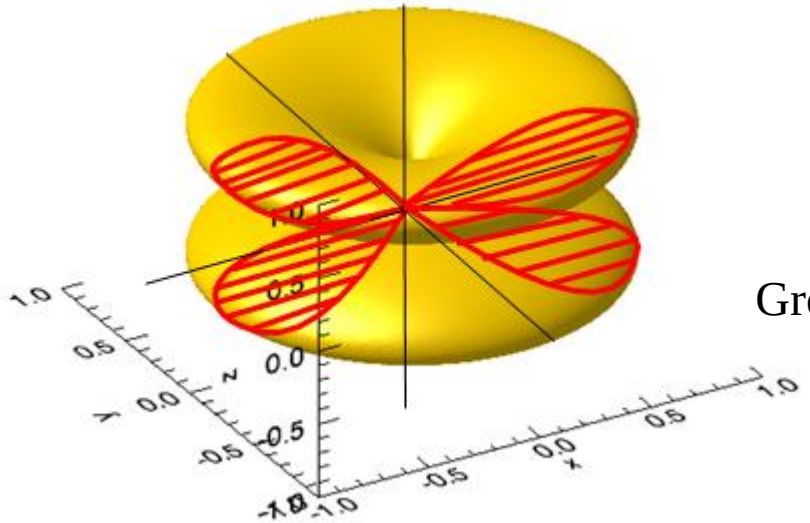
Jicamarca Antenna Pattern: Basic Patterns

Dipole lambda/2



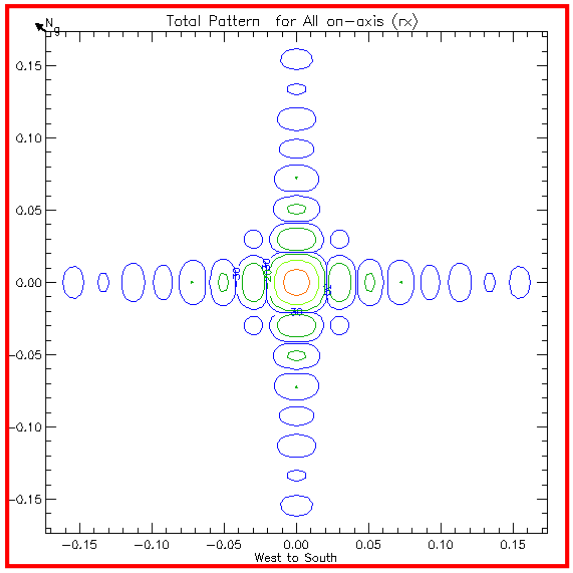
Ground lambda/4

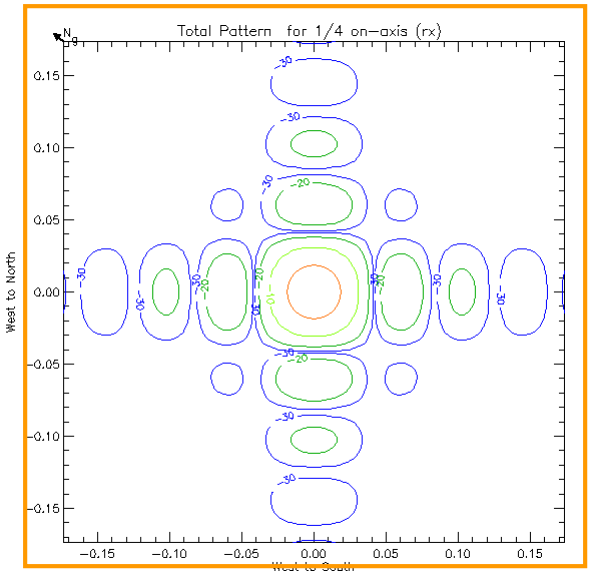


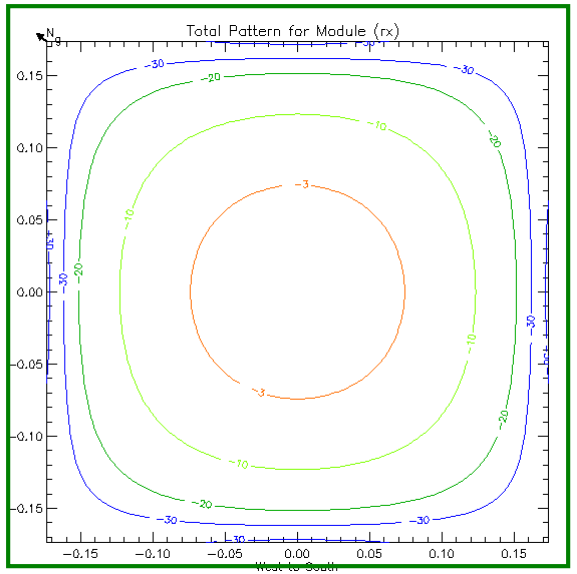


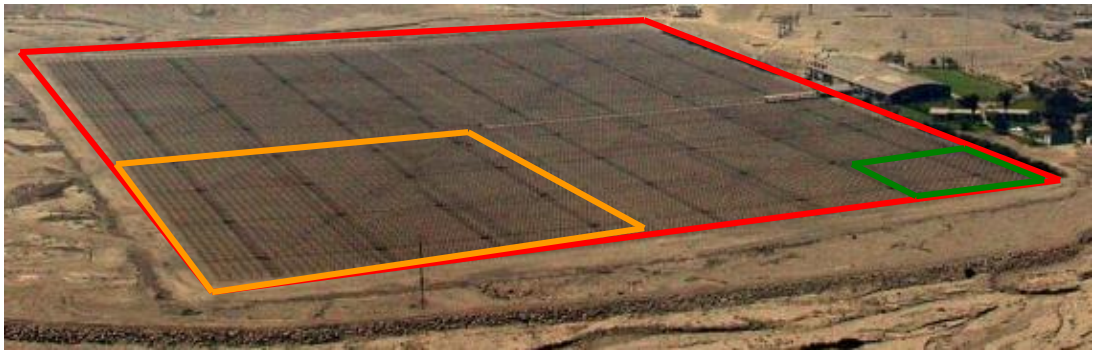
Ground lambda/2

Jicamarca Antenna Pattern: Basic Array Patterns









$$\theta_{BW} \sim \frac{\lambda}{D} \quad ; \quad G_{\max} \sim 4\pi \frac{A}{\lambda^2}$$

θ_{BW} : antenna 3dB beamwidth in radians

$G_{\max}$: maximum antenna gain.

λ : radar wavelength in meters

D : antenna size in the direction of interest

A : Antenna area in m^2

Jicamarca Antenna: Coordinate System

- The antenna x,y axis are rotated θ~51.01 degrees respect to Geographic coordinates. Geographic North is slightly to the left of the NS diagonal.
- The y axis is tilted 1.46 degrees respect to horizontal.
- Usually, most phenomena are referenced to geographic coordinates, then a transformation of coordinate system is needed. This transformation can be done a very simple manner (e.g., Lucia Villanueva thesis) with a Matrix operator. For example

  MT1 = [[1,0,0],[0,COS(alfa),-SIN(alfa)],[0,SIN(alfa),COS(alfa)]]

  MT2 = [[COS(theta1),SIN(theta1),0],[-SIN(theta1),COS(theta1),0],[0,0,1]]

  MT3 = TRANSPOSE(MT2 ## MT1)

  xg = MT3 # [1,0,0]

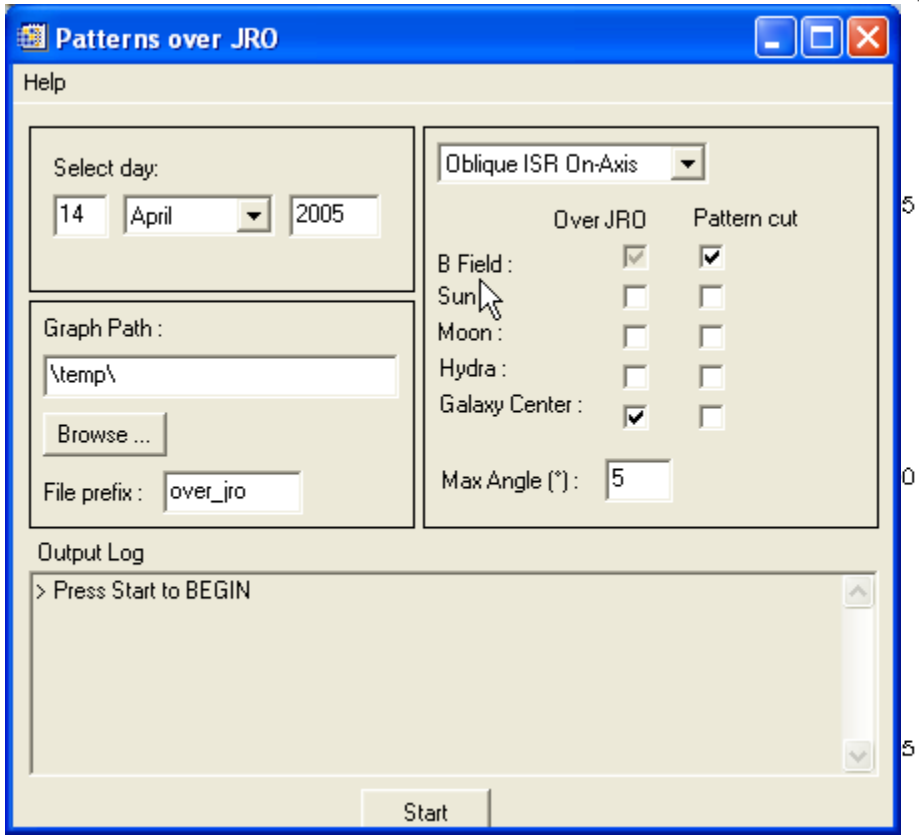
  yg = MT3 # [0,1,0]

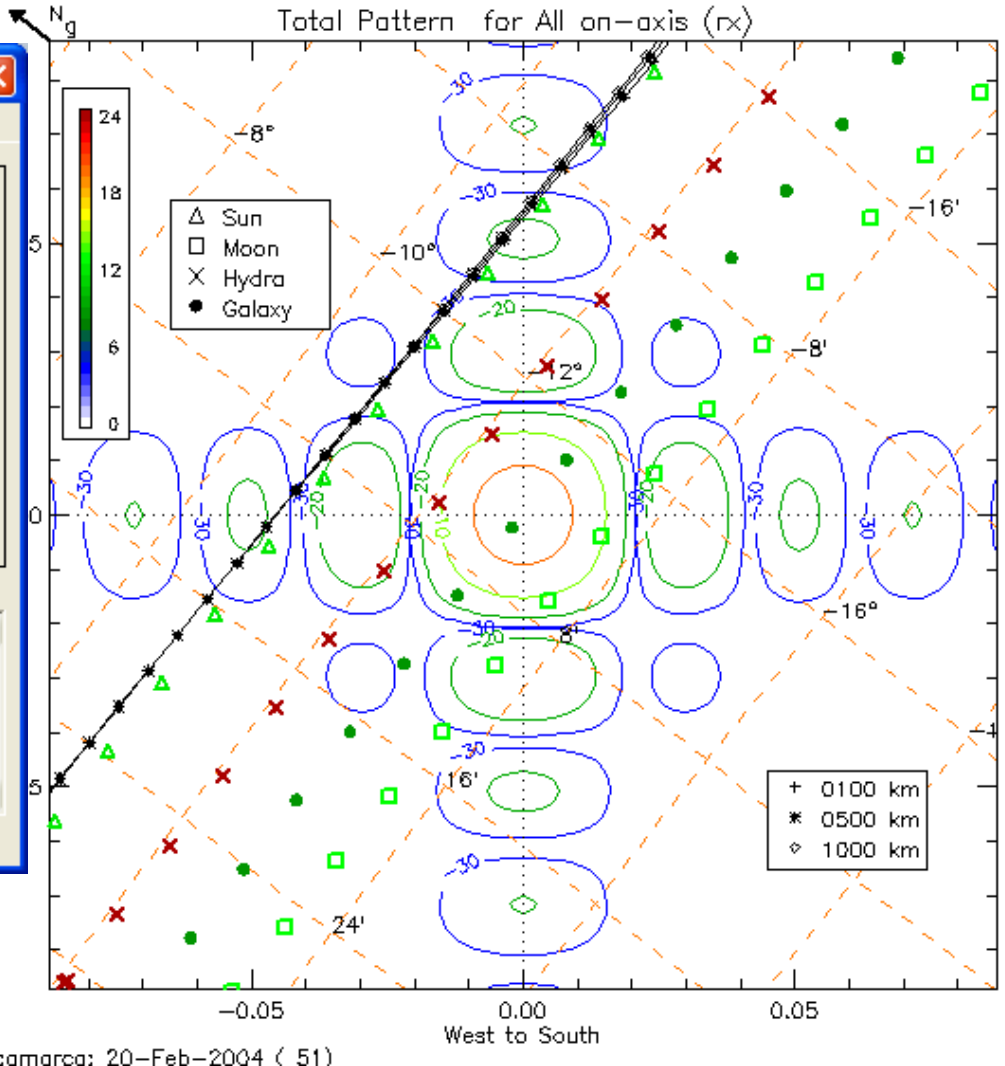
  zg = MT3 # [0,0,1]

  - The new Jicamarca axis vector in geographic coordinates are given by xg, yg, and zg.
  - Rg = MT3 # Rjro

Useful Programs: Over_JRO

http://jro.igp.gob.pe/programs/Over_JRO/html/over_jro.htm

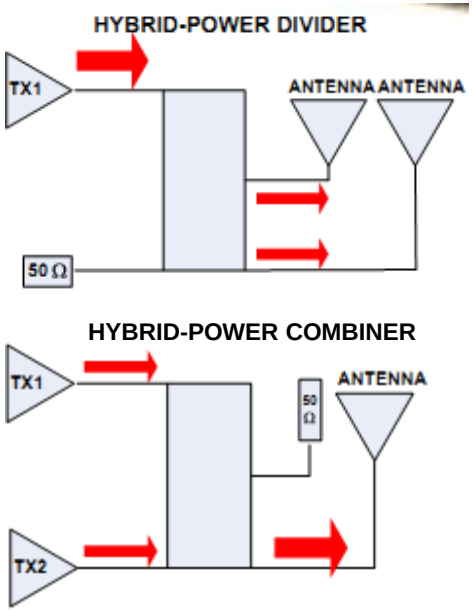




Jicamarca Antenna: Feeding Connections

Hybrids

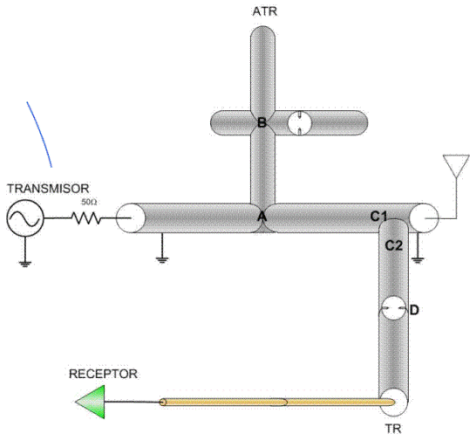
- Jicamarca have three hybrids for tx and four for rx.




Hybrid

T/R Swicthes


ATR



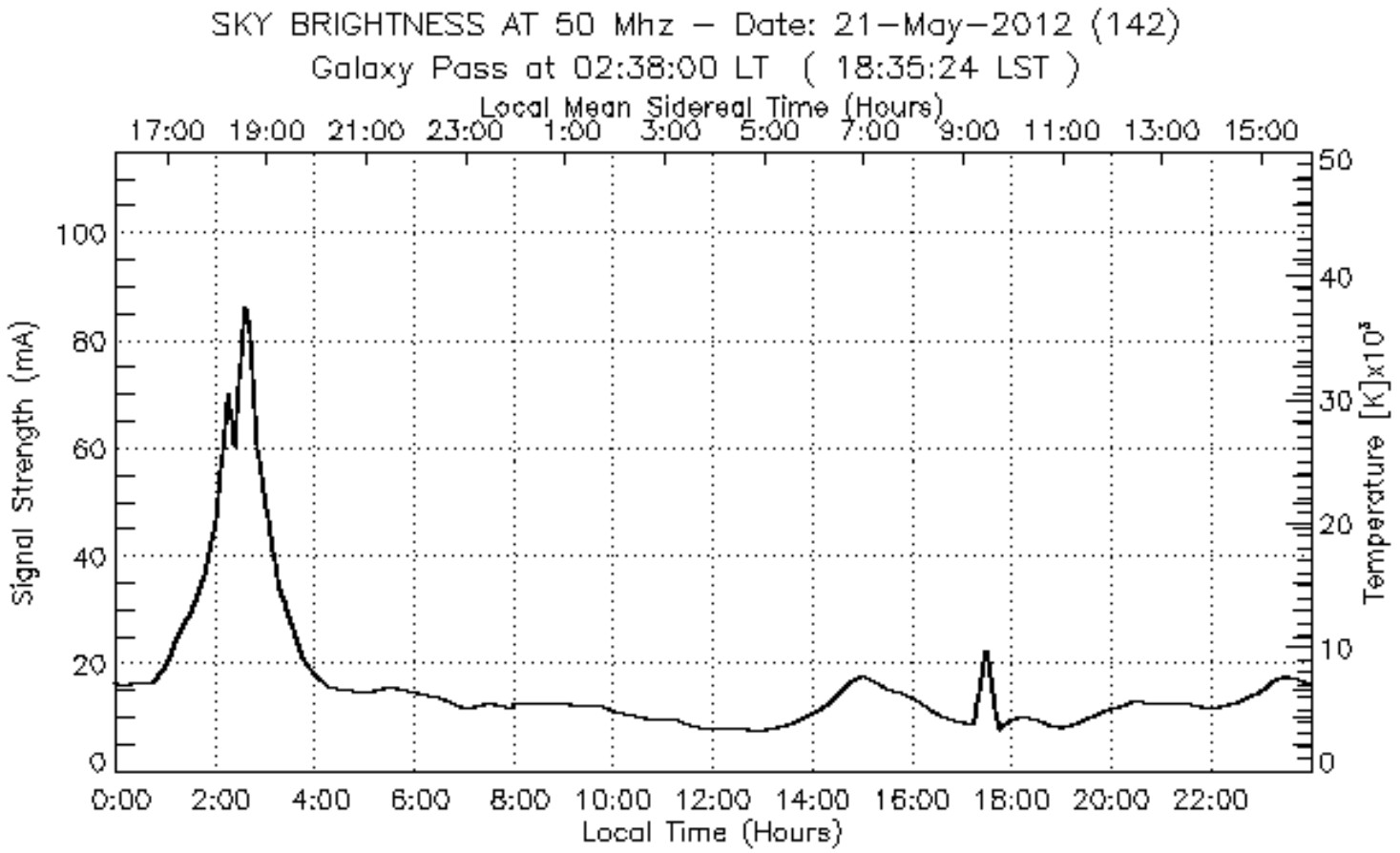
TR

Tx's: "big" txs, "MST" txs

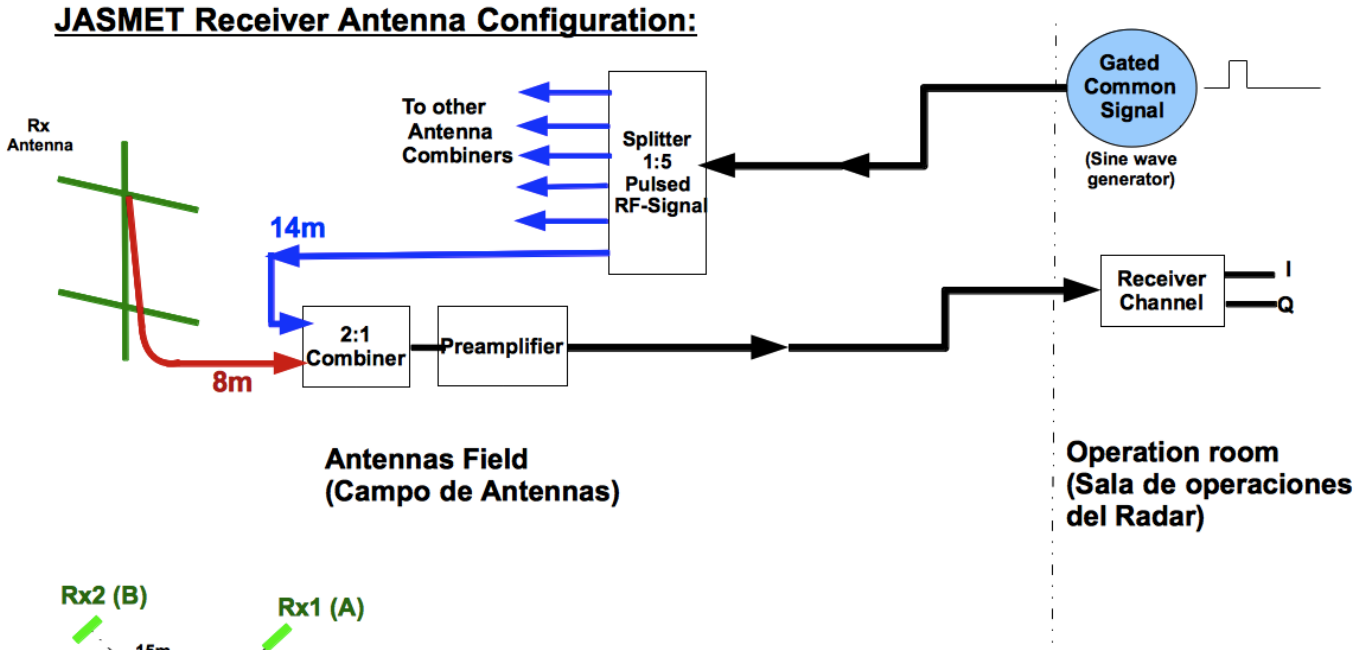
Module cables and U sections

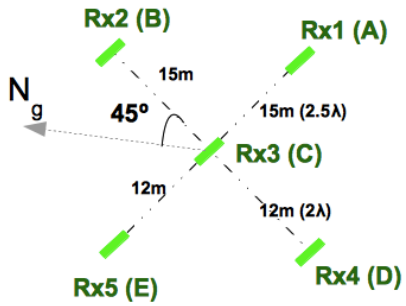
Useful Programs: Sky_noise

http://jro.igp.gob.pe/programs/skynoise/skynoise_en.php



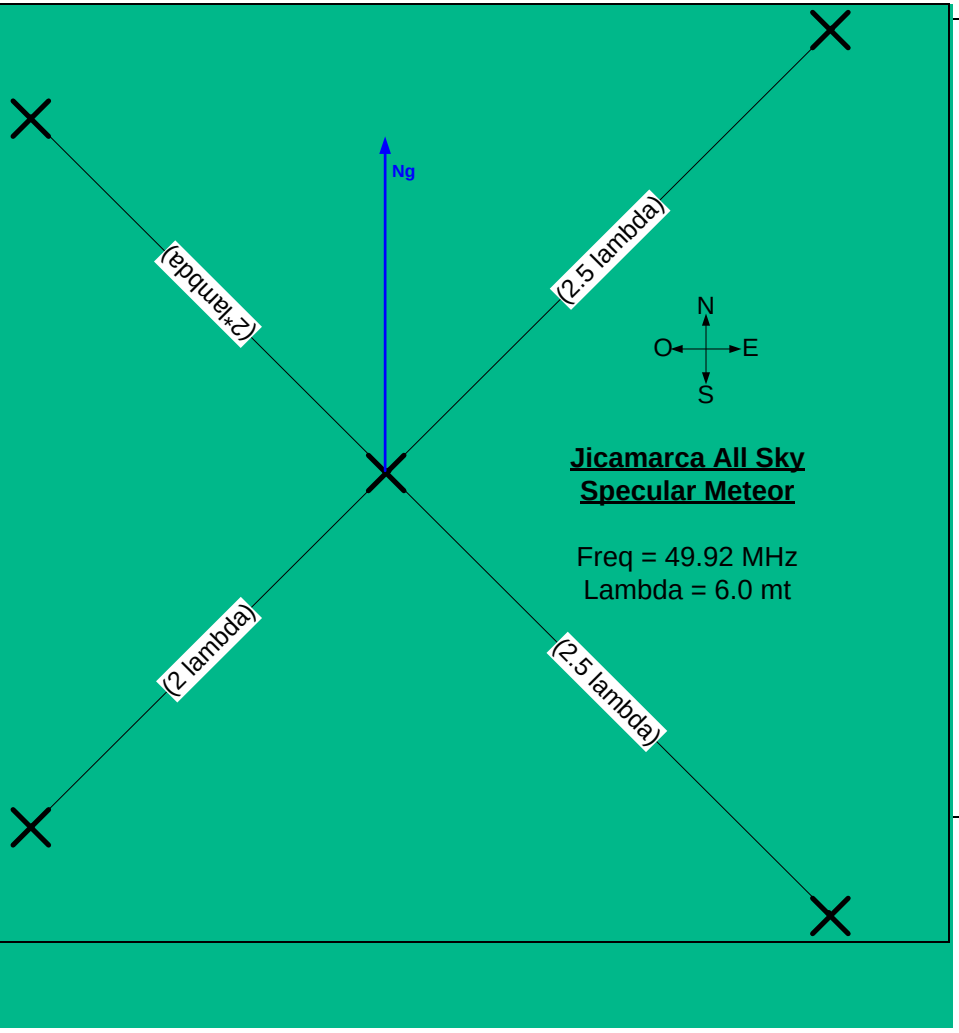
Configuración JASMET Recepción



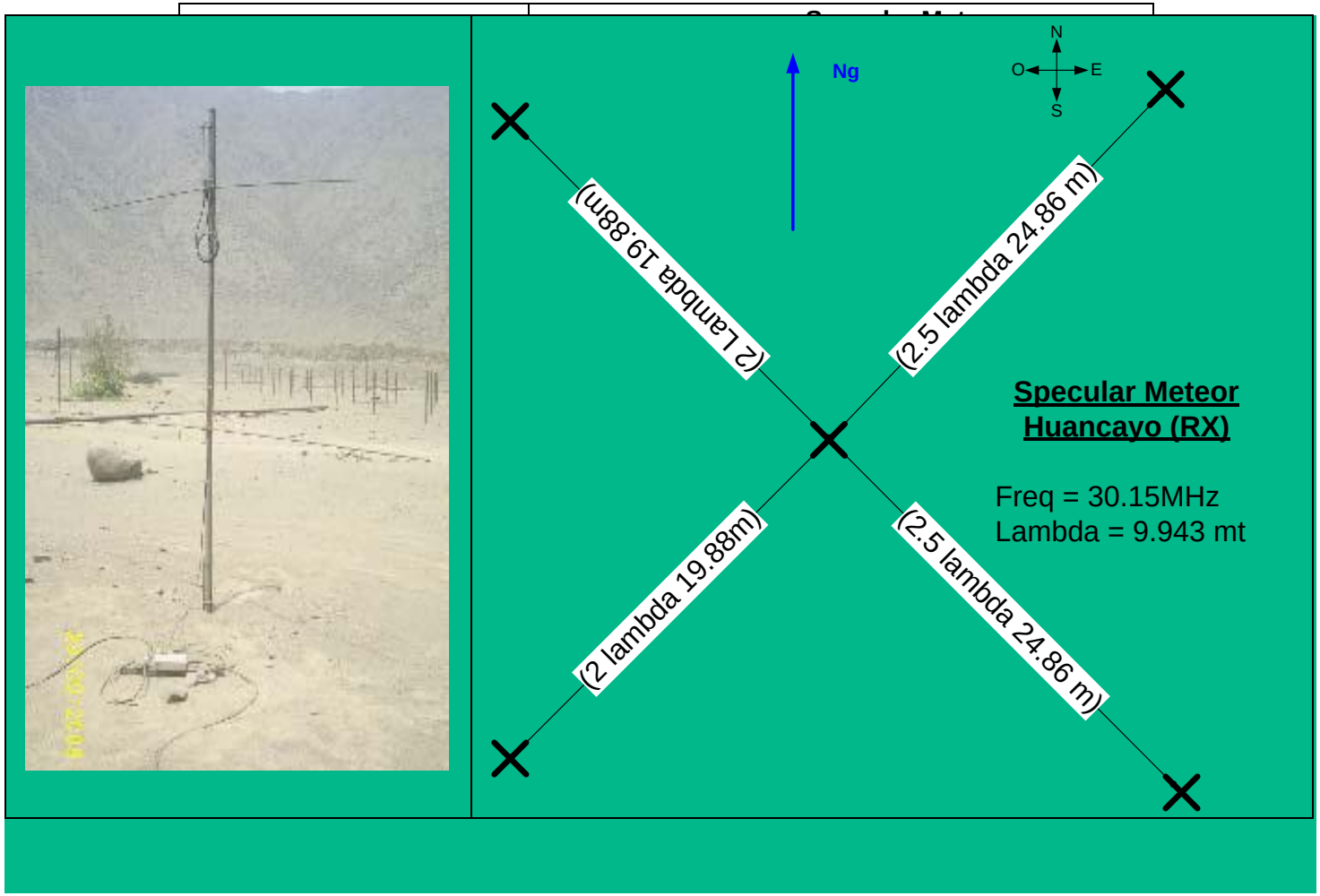


Receiver antennas distribution

Configuración Antenas JASMET 50 MHz



Configuración Antenas JASMET 30 MHz



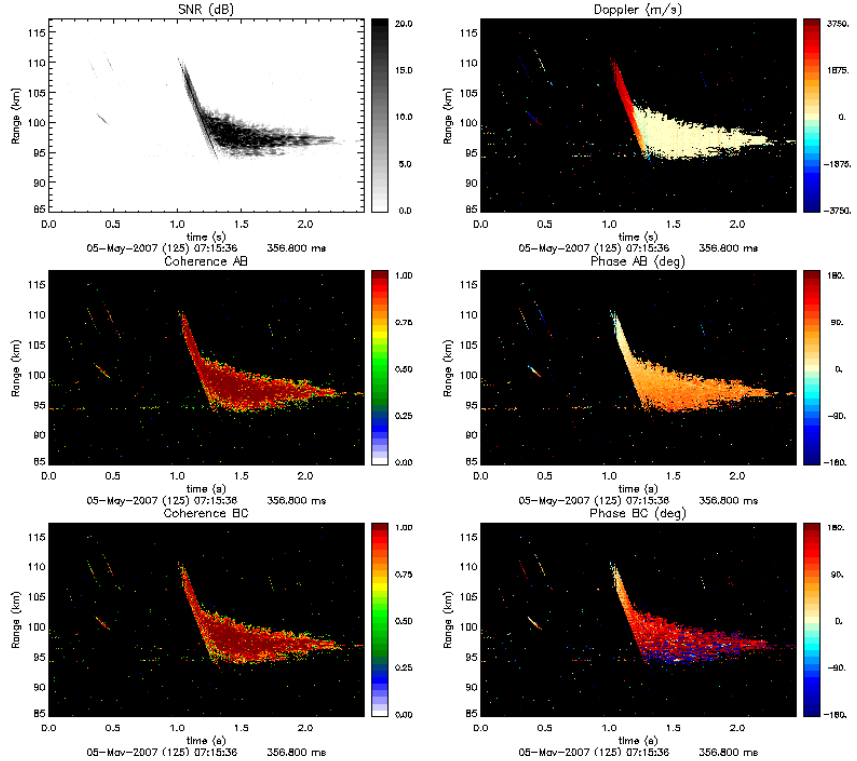
JASMET Results

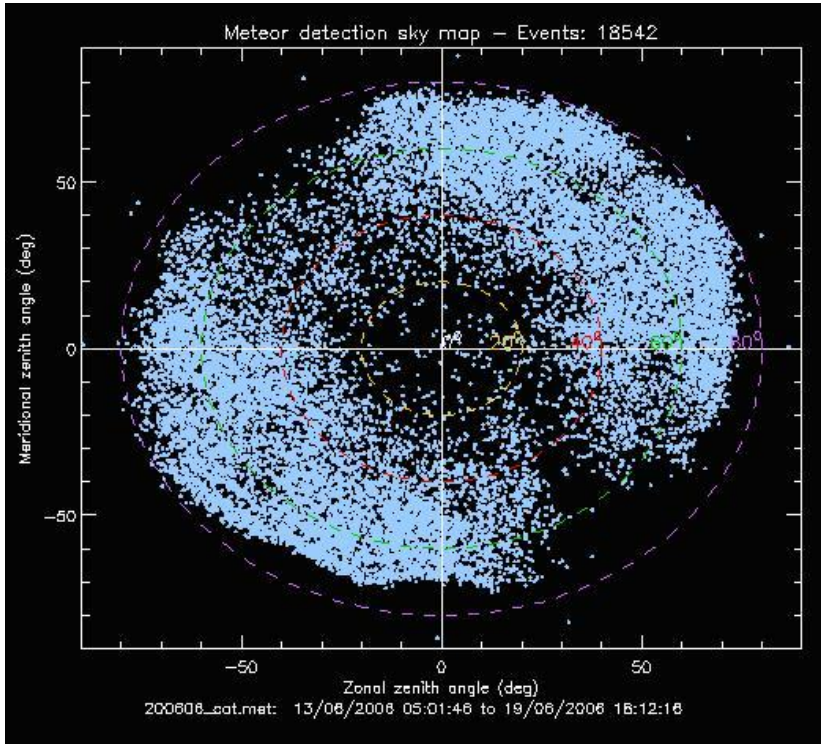
Meteor trails

- Specular
  - Echoes come when the meteor trail is perpendicular to the antenna pointing.
- Non-specular
  - Echoes come when the meteor trail is perpendicular to **B**.

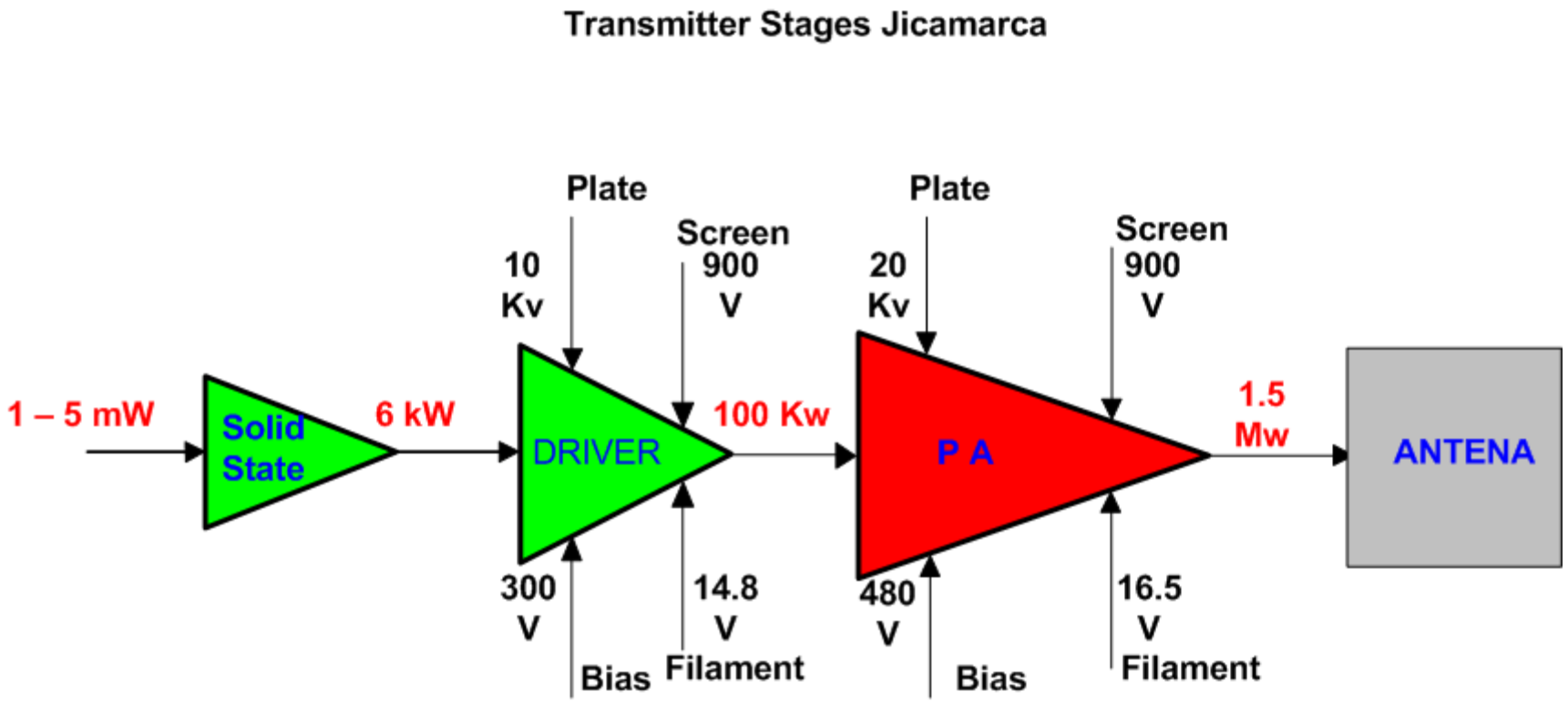
– Meteor Heads

- No dependence on Jicamarca pointing directions

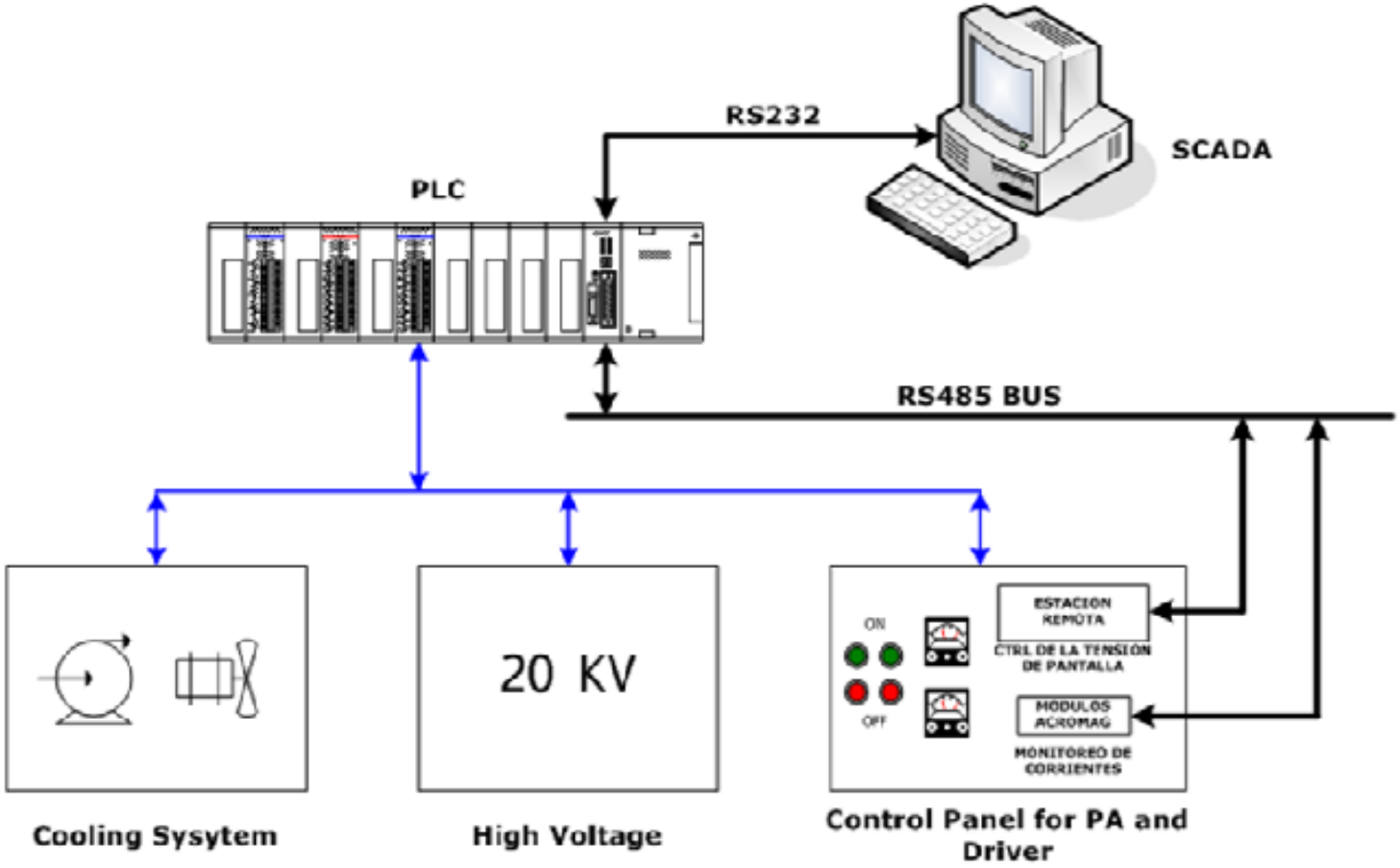




Jicamarca Transmitter



Jicamarca Transmitter



External Connections of PA

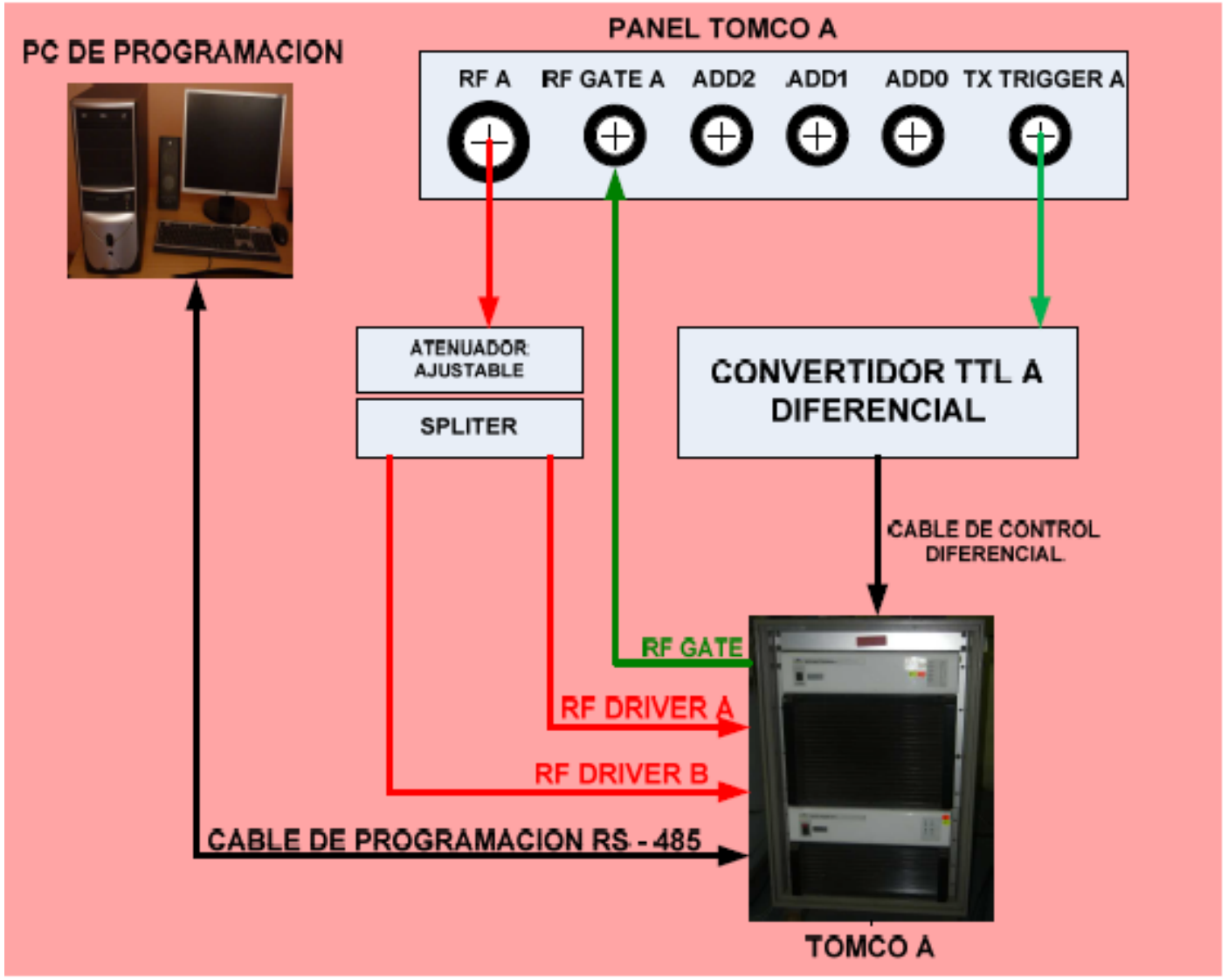
External Connections of PA

1) Input Cavitiy
2) Output Cavitiy
3) High Pressure water input
4) 20 kV (Plate Voltage)

Driver

Jicamarca Cooling System for Transmitte

Low Power TX


PC DE PROGRAMACION
PANEL TOMCO A
RF A
RF GATE A
ADD2
ADD1
ADD0
TX TRIGGER A
ATENUADOR AJUSTABLE
SPLITER
CONVERTIDOR TTL A DIFERENCIAL
CABLE DE CONTROL DIFERENCIAL
RF GATE
RF DRIVER A
RF DRIVER B
CABLE DE PROGRAMACION RS - 485
TOMCO A

Low Power TX