

First Geodetic Result of **Ishioka** VGOS Station in Japan

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Ishioka VGOS Station



Ishioka 13m antenna



Content

- Introduction
- Receiving performance
with tri-band & Eleven feed
- Geodetic result in legacy S/X-band
- RFI
- Summary

Photo of the antenna (1)



1. Antenna (Single type)

Diameter : 13.2m

Optics : Ring Focus

Frequency: 2-14GHz

Aperture Efficiency: $\geq 50\%$

Antenna Noise Temperature: $\leq 10\text{K}$

(Excl. Atmosphere Contribution)

Reference Point Stability : $\leq 0.3\text{mm}$ (rms)

Path Length Stability : $\leq 0.3\text{mm}$ (rms)

Reference Point can be measured directly
from the ground for Co-location!

Driving Speed

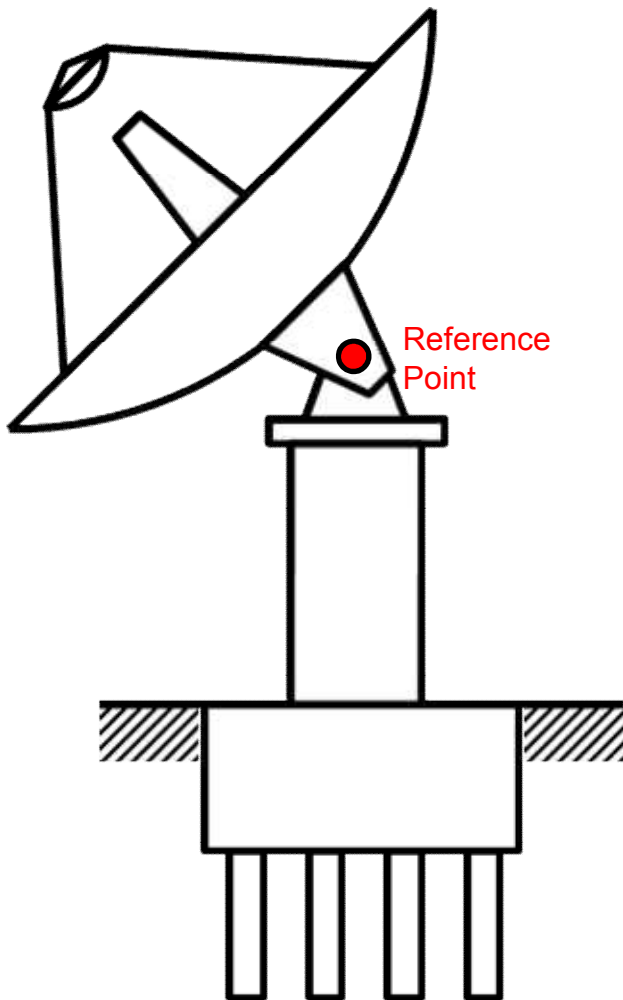
Az slew rate: 12 deg/sec

El slew rate: 6 deg/sec

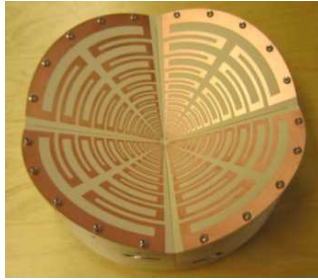
Az acceleration: 3 deg/sec²

El: acceleration: 3 deg/sec²

Optical Fiber cable: from Antenna to Building



2. Front-end



Developed by Chalmers University of Technology



Developed by Caltech

Frequency: 2-14GHz
 (Eleven feed was assumed
 for antenna design.)

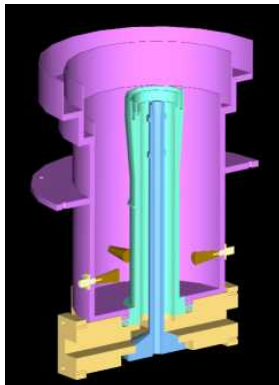
2 types of broadband feed purchased.

- 1) **Eleven feed**
- 2) **Quadruple-Ridged Flared Horn (QRFH)**

Receiver Noise Temperature: $\leq 30\text{K}$

System Noise Temperature: $\leq 40\text{K}$

(Excl. Atmosphere Contribution)

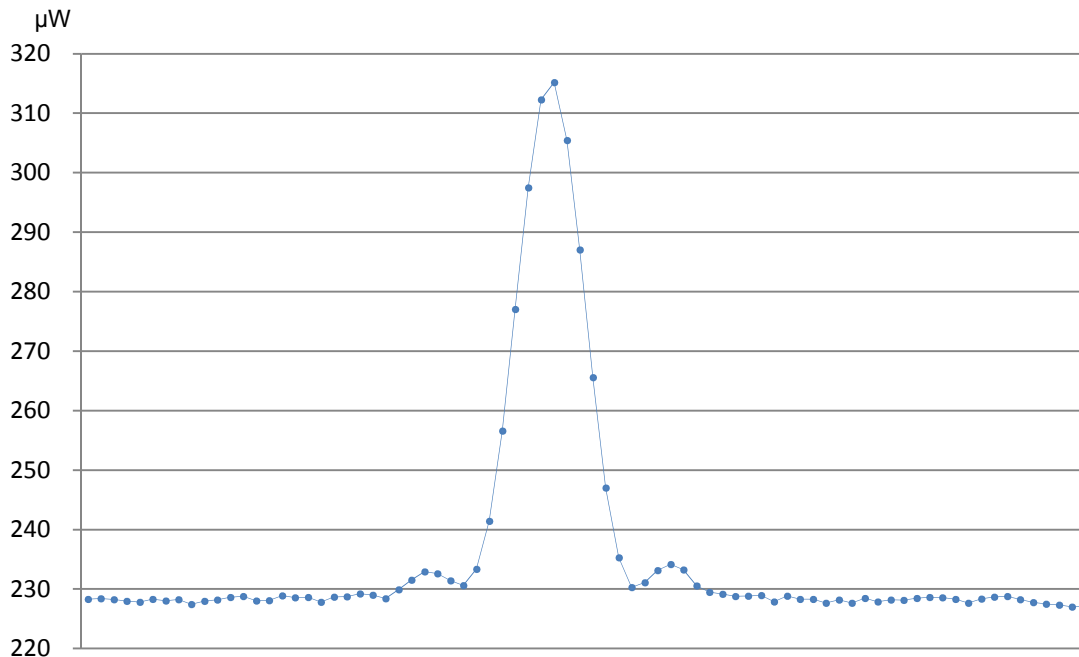


Developed by Spanish IGN (Yebes Observatory)

For compatibility with legacy system,

Tri-band (S/X/Ka) feed system purchased

First Light !



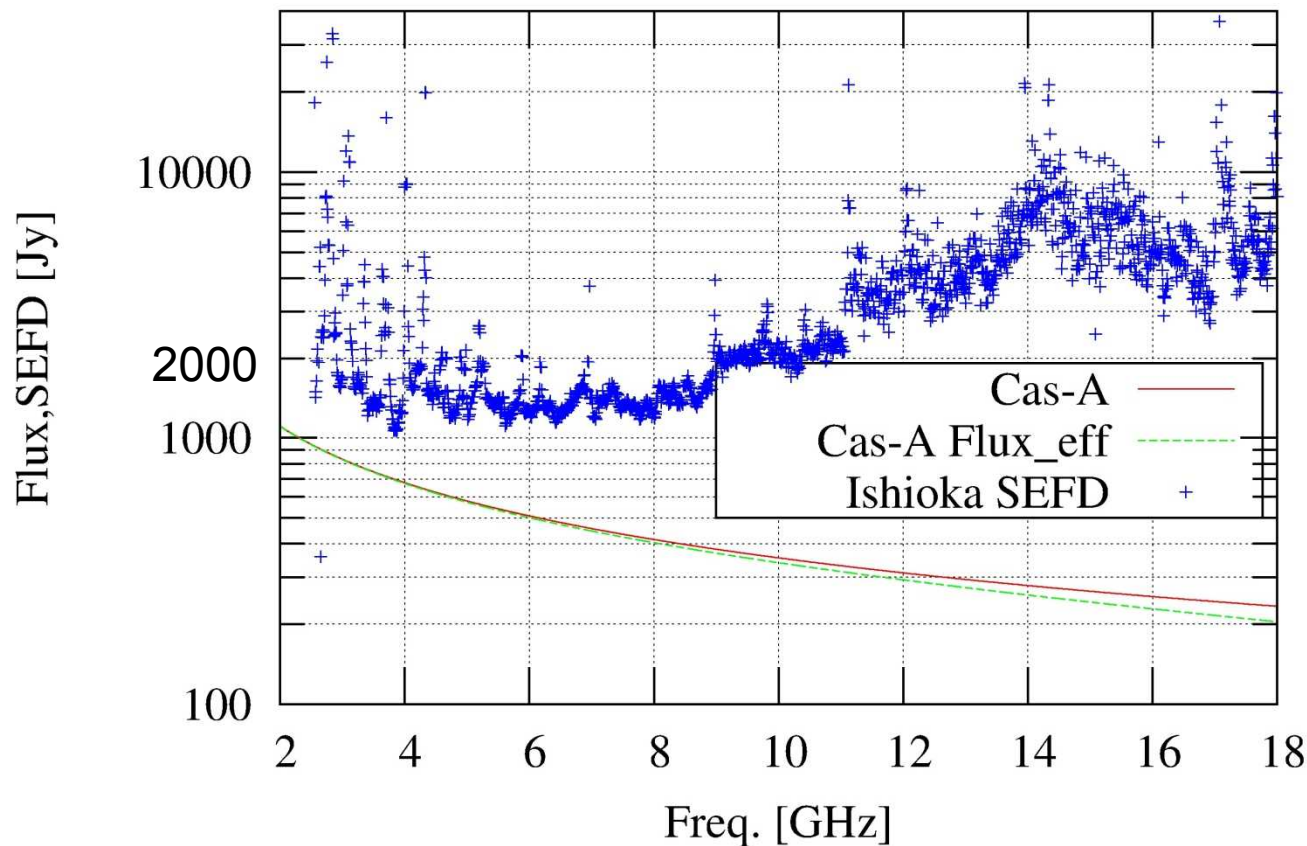
Cross scan data of Taurus-A
with Tri-band feed
at X band (BW: 900MHz)

According to Y factor, the SEFD is calculated as **1,250Jy**.
Assuming that System Noise Temperature is 50K,
the aperture efficiency is **77%!**

Broadband receiving performance with Eleven feed (preliminary)

By installing Eleven feed on the antenna, we received the signal from Cas-A and measured the Y-factor in order to calculate SEFD value.

Ishioka VOGS Station



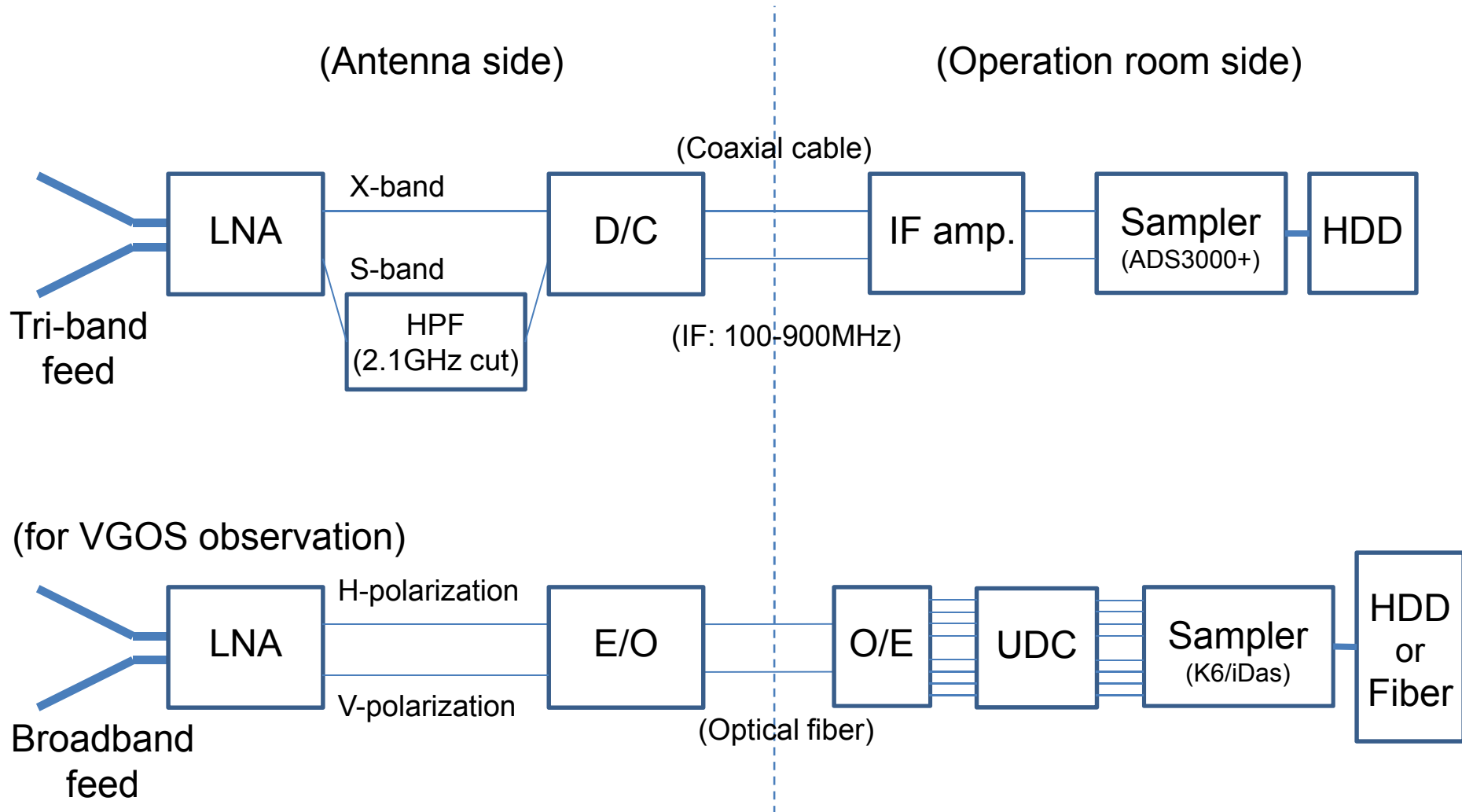
- less than 10GHz
Efficiency: 40~50%
Tsys : 30~40K

- more than 10GHz
Efficiency: 30~40%
Tsys : 30~50K



As a next step,
Improvement of QRFH
will be done.

Legacy S/X band receiving system for Ishioka antenna



First geodetic result

Ishioka—Tsukuba baseline length:
2015.

Feb. 19: $16,606,288.71 \pm 1.58$ mm

Mar. 05: $16,606,290.88 \pm 1.04$ mm

Mar. 12: $16,606,285.38 \pm 1.39$ mm

Apr. 23: $16,606,291.41 \pm 1.31$ mm

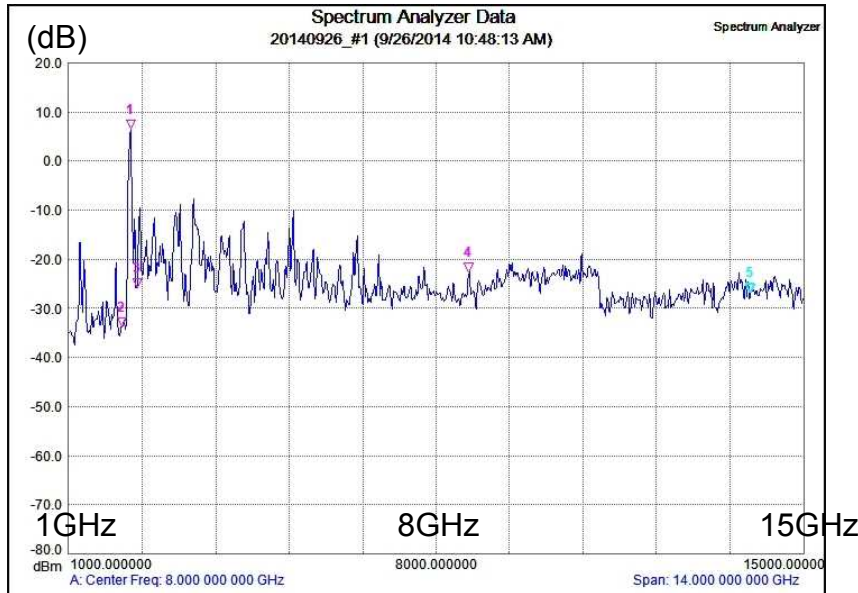
Latest coordinates of Ishioka antenna:

X: $-3,959,635,382.72 \pm 3.595$ mm

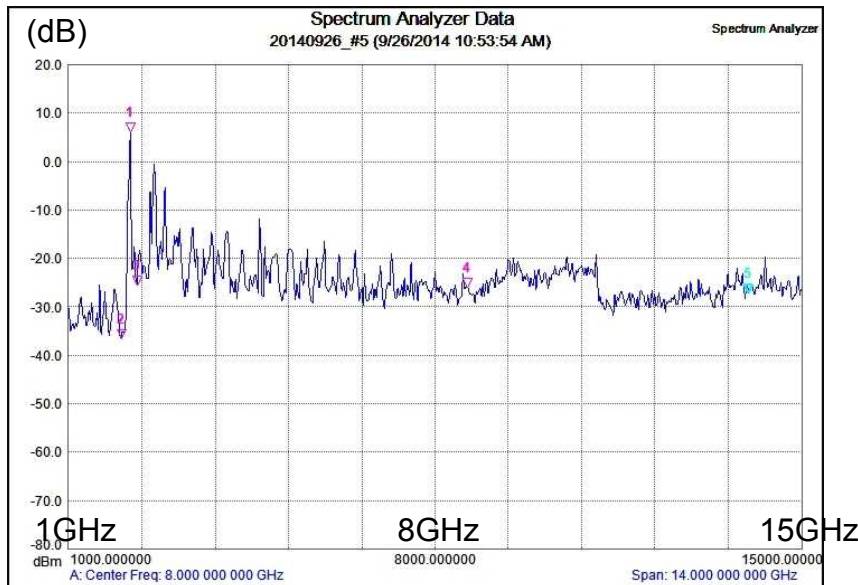
Y: $3,296,826,176.87 \pm 3.290$ mm

Z: $3,747,042,746.42 \pm 3.545$ mm

RFIs by broadband receiving



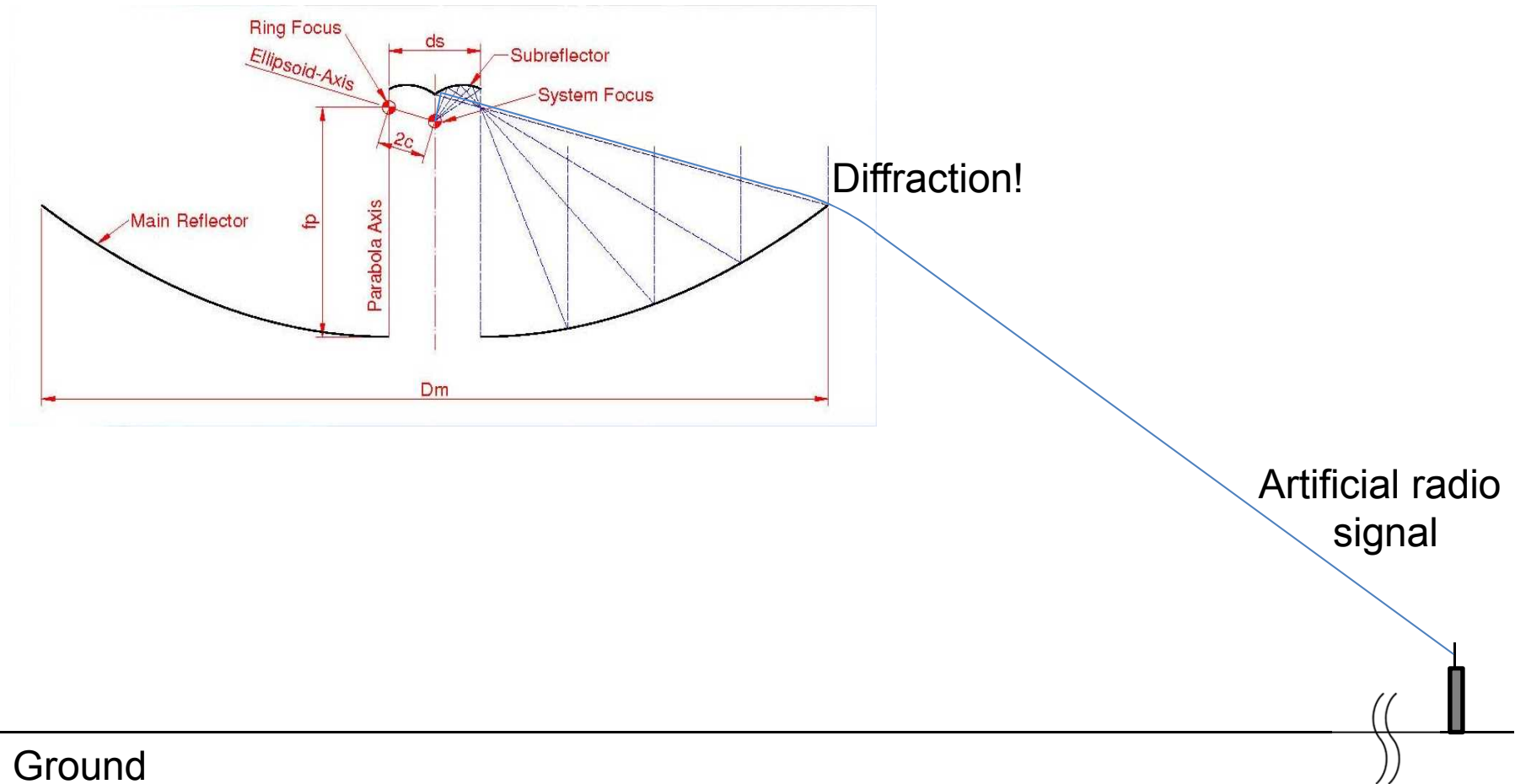
Eleven feed : H polarization



Eleven feed : V polarization

High Pass Filters to cut less than 2.2GHz
are inserted before the 2nd Amps.

Artificial signals easily reach the feed!



Ground

Summary

- New project for constructing new VGOS Station is now in progress in Japan.
- New VLBI observing facilities are installed, fully compliant with VLBI2010 (VGOS) concept.
- Construction of the antenna was completed, and the receiving performance was measured.
- First geodetic result was obtained in S/X mode.
- In 2015 & 2016 domestic local-tie observations with old antennas (Tsukuba & other stations) will be carried out in legacy S/X band mode.

Thank you very much
for your attention!