Construction on site, electronic system, and testing experiment of Tianlai project

Fengquan Wu
NAOC,Beijing

Paris 21cm workshop, June 2014

Schedule

- July Finish the road

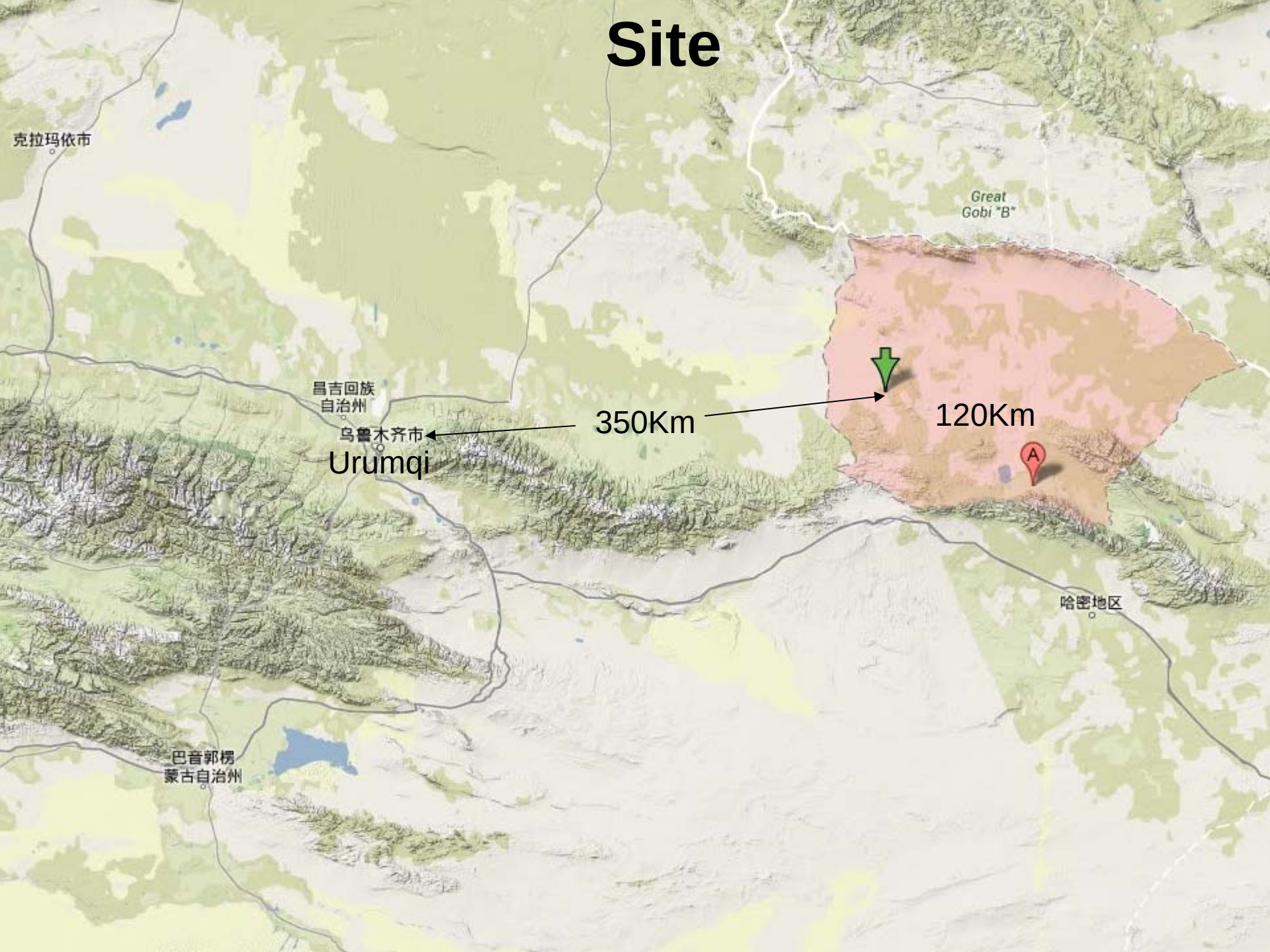
  Begin to build living area(2 months)

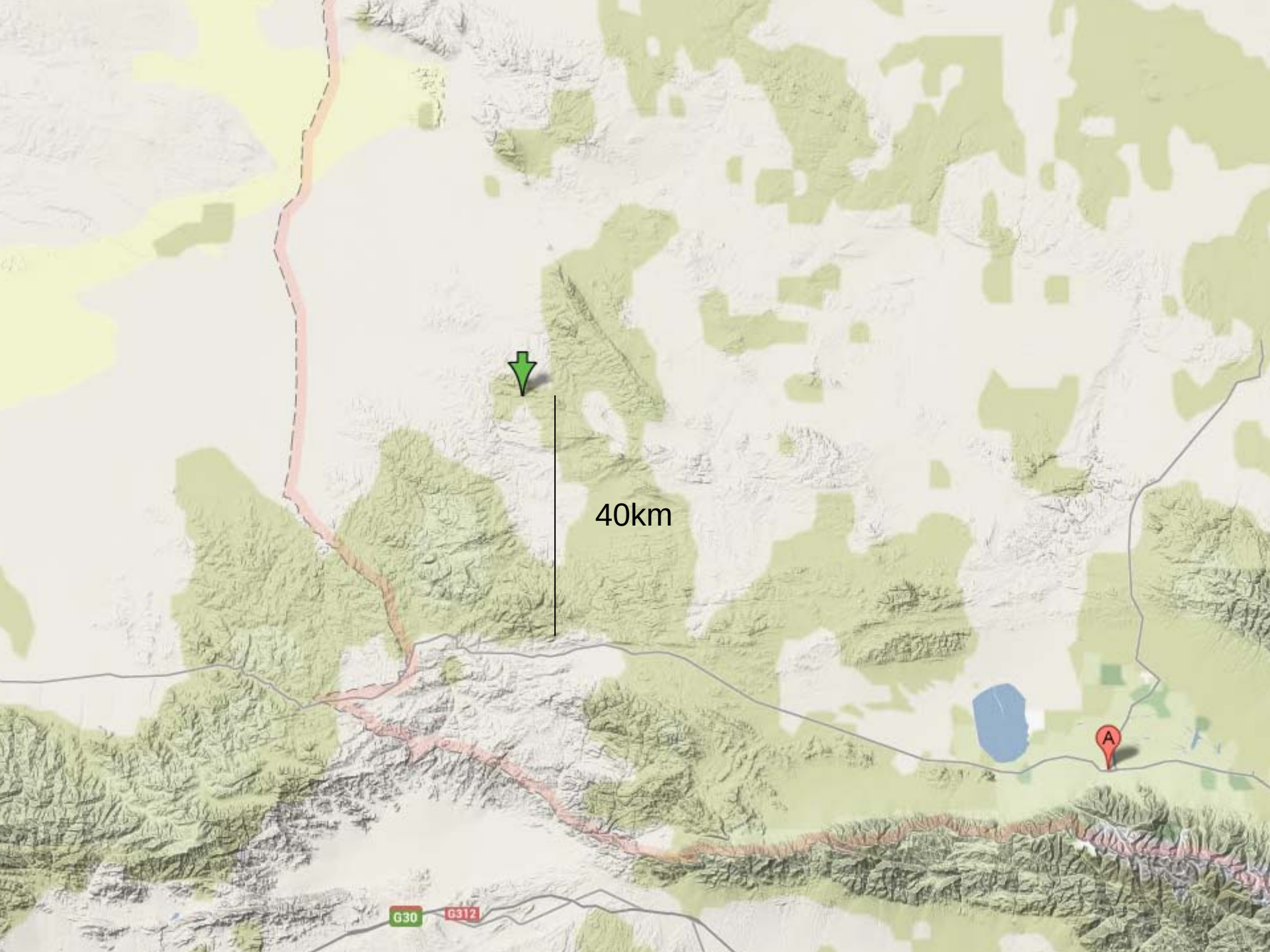
  Begin to build pedestals for antenna(two weeks)
- Sep. Finish the testing on instrument system
- Oct. Begin to install the cylinder antenna(2 months)
- ----------
- Jan. new receiver, correlator on site
- Feb. Testing …..

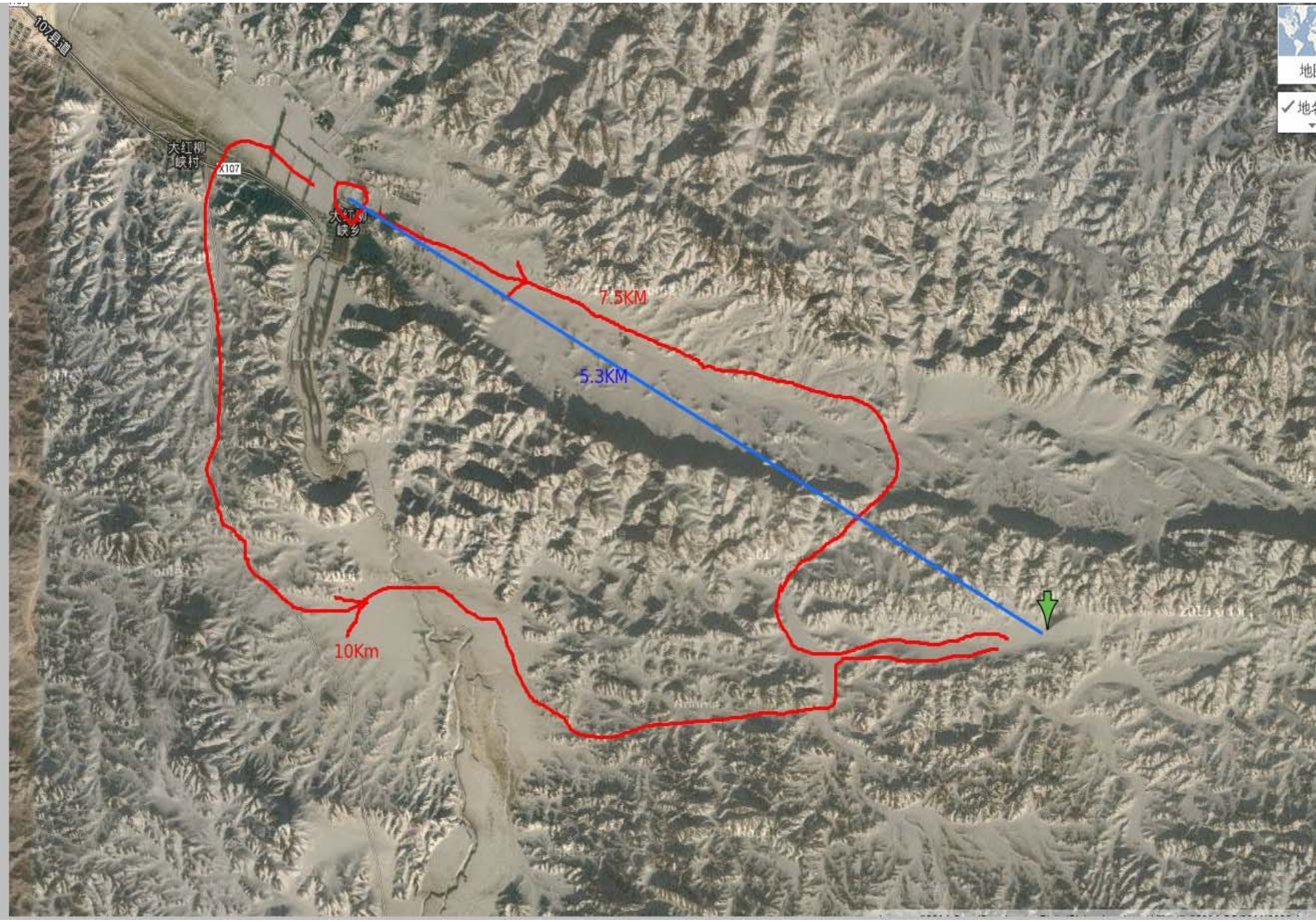
Site


A
2000Km
Beijing
Новосибирск
Астана
Astana
Қазақстан
Улаанбаатар
Ulaanbaatar
Монгол Улс
Алматы
Almaty
Бишкек
Bishkek
Кыргызстан
Тошкент
Samarqand
Тоҷикистон
Kabul
افغانستان
Rawalpindi
Lahore
پاکستان
New Delhi
नेपाल
Bhutan
Jaipur
Lucknow
Karachi
Ahmedabad
India
বাংলাদেশ
Kolkata
Myanmar (Burma)
Mumbai
Pune
Hyderabad
Yangon
Bangalore
Chennai
Bay of Bengal
Andaman Sea
Sri Lanka
Gulf of Thailand
Thành Phố Hồ Chí Minh
ประเทศไทย
กรุงเทพมหานคร
Việt Nam
ប្រទេសកម្ពុជា
ປະເທດລາວ
Hà Nội
中国
北京
成都
重庆
武汉
上海
广州
香港
Hong Kong
澳門
South China Sea
East China Sea
Sea of Japan
북한
Pyongyang
평양
서울
대한민국
日本
東京
名古屋
大阪
広島
福岡
札幌
Maynila
Luzon
Pilipinas
Kabisayaan
Palawan
Isla sang Negros
Leyte
Sulu Sea
Mindanao
地图数据 ©2014 GS(2011)6020 Bas

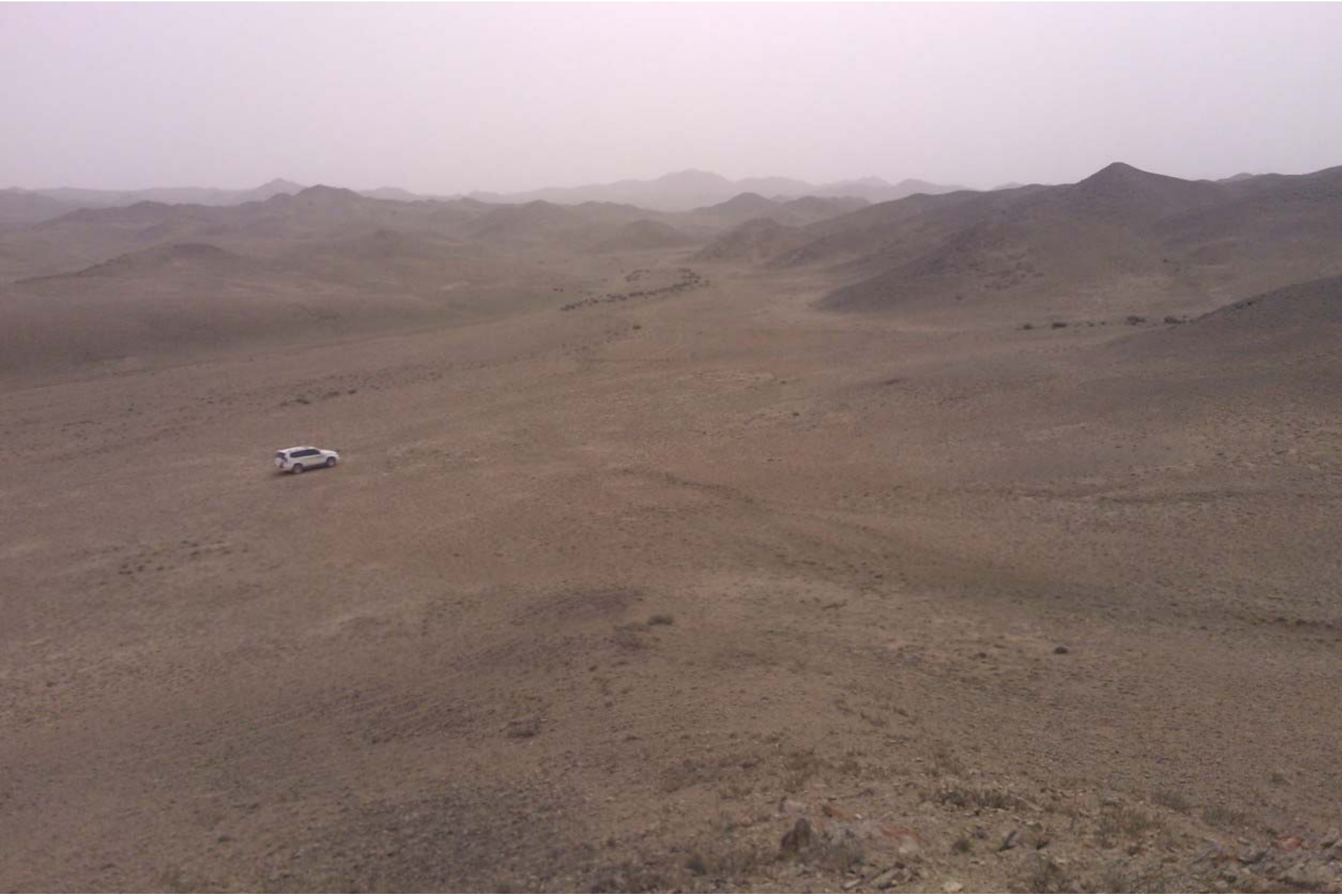
Site

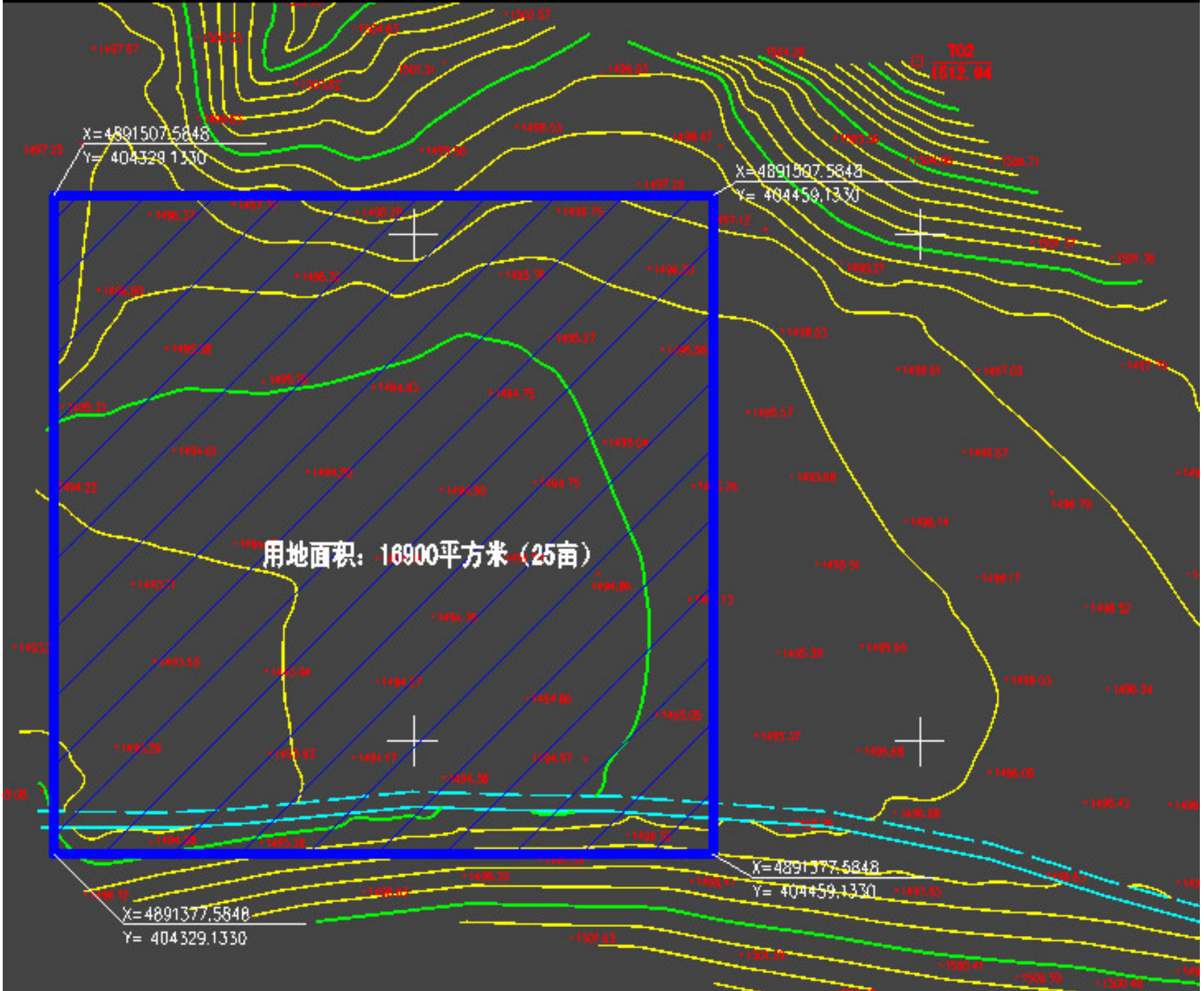

克拉玛依市
Great
Gobi "B"
昌吉回族
自治州
乌鲁木齐市
Urumqi
350Km
120Km
A
哈密地区
巴音郭楞
蒙古自治州

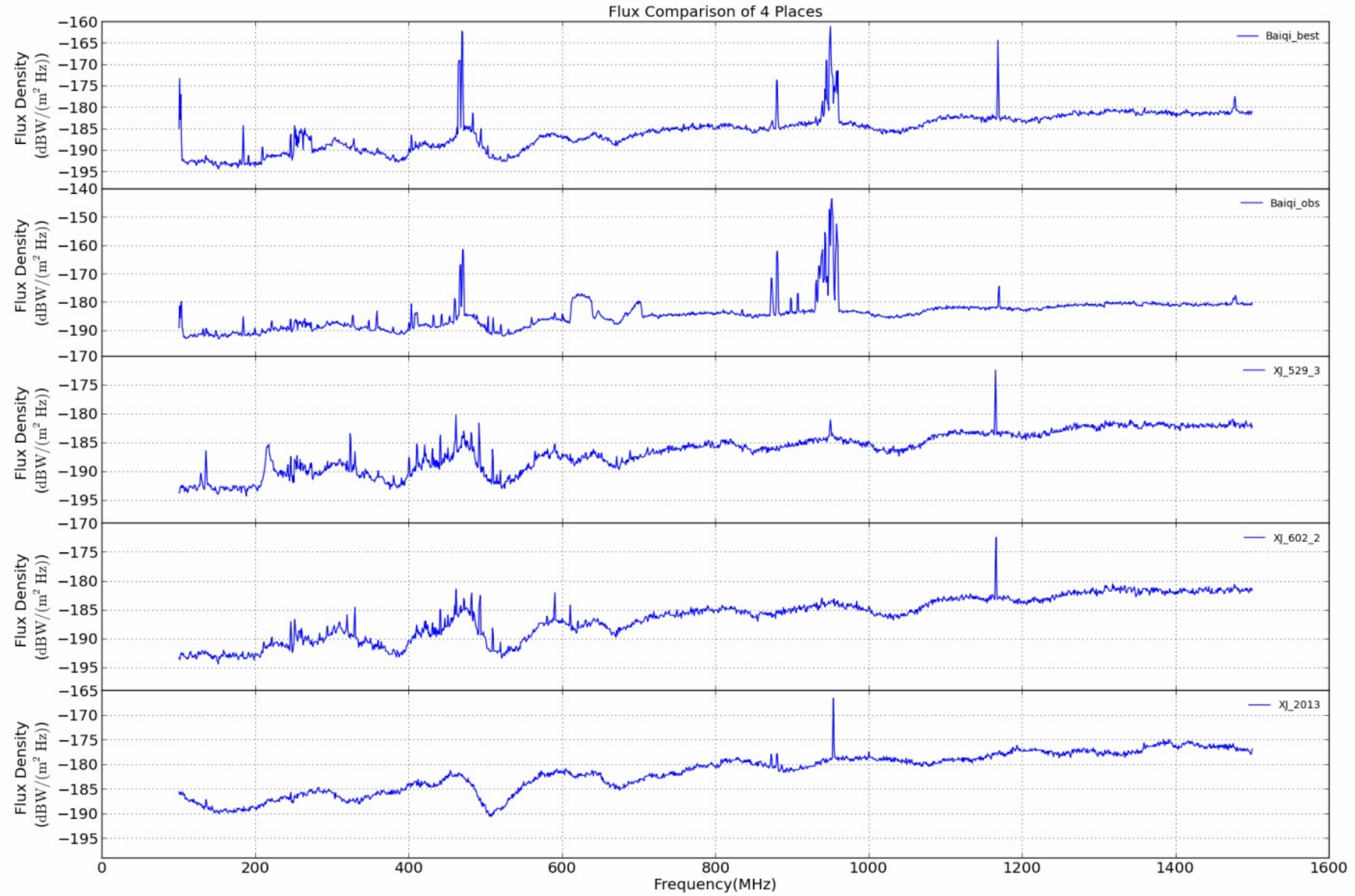

40km
A
G30
G312


107国道
大红柳峡村
X107
大红柳峡乡
7.5KM
5.3KM
10Km


150m
1.4 km

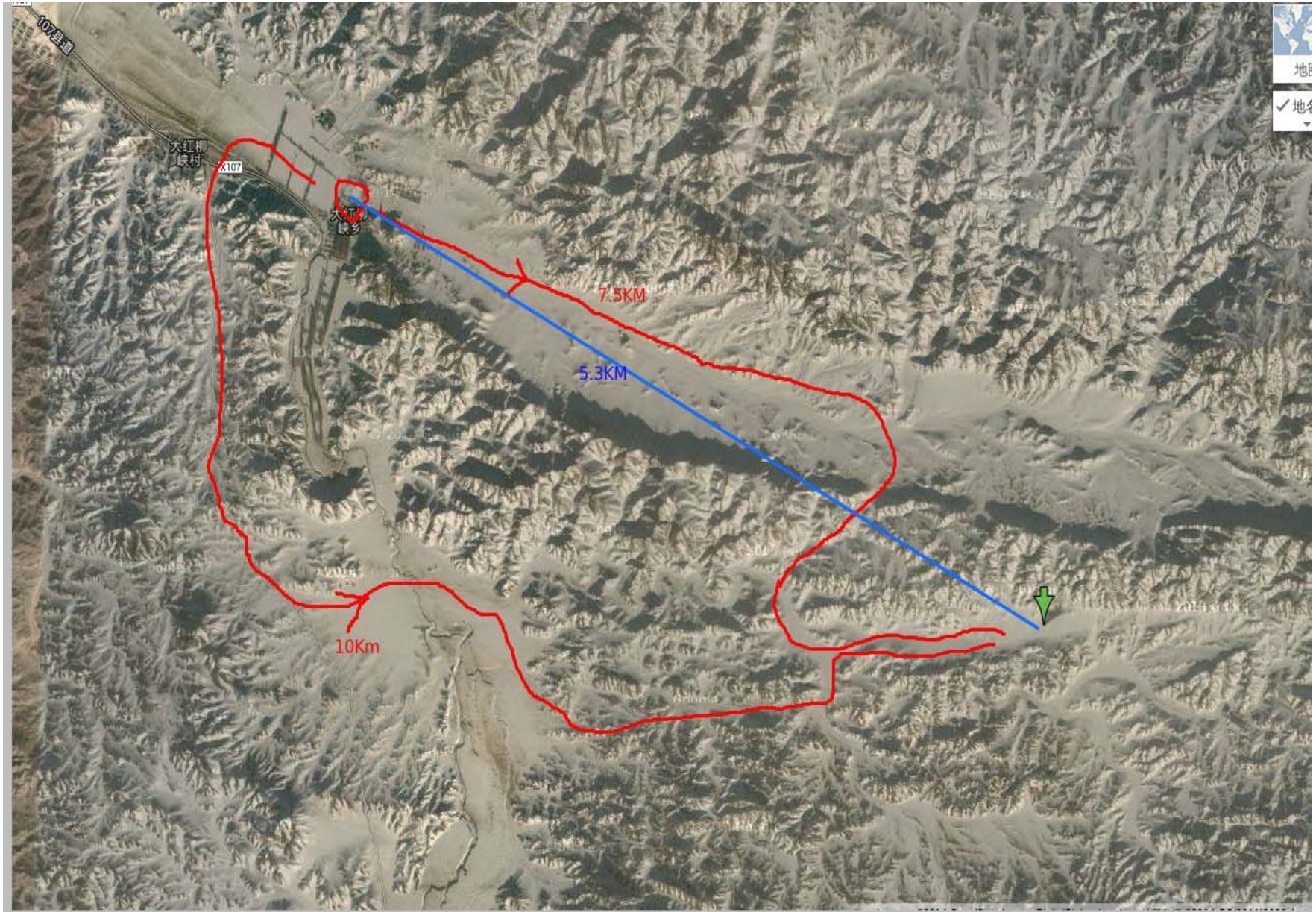



TQ2
1512.64
X=4891507.5848
Y= 404329.1330
X=4891507.5848
Y= 404459.1330
用地面积：16900平方米（25亩）
X=4891377.5848
Y= 404459.1330
X=4891377.5848
Y= 404329.1330


Flux Comparison of 4 Places
Baiqi_best
Baiqi_obs
XJ_529_3
XJ_602_2
XJ_2013
Flux Density
(dBW/(m² Hz))
Frequency(MHz)
0
200
400
600
800
1000
1200
1400
1600

Open Issues for site

(1) Where to put the Rceiver & correlator?



Open Issues for site

(1) Where to put the Rceiver & correlator?

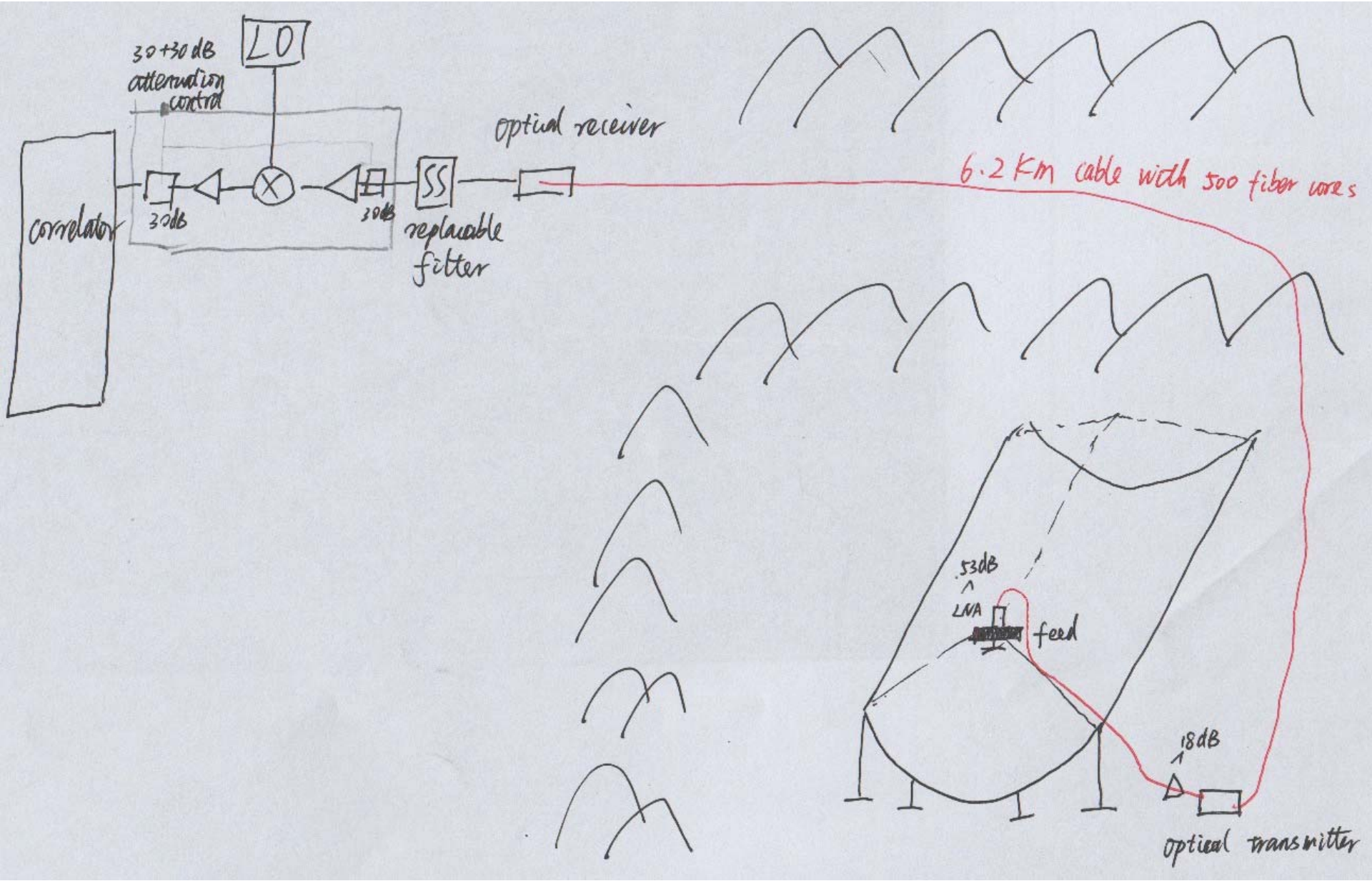
A: Will it increase more nonlinear effect?
B: Cost? Plan I : cable(6.5km 50k￥),
Install(10k?on pole,30k buried)>=60K

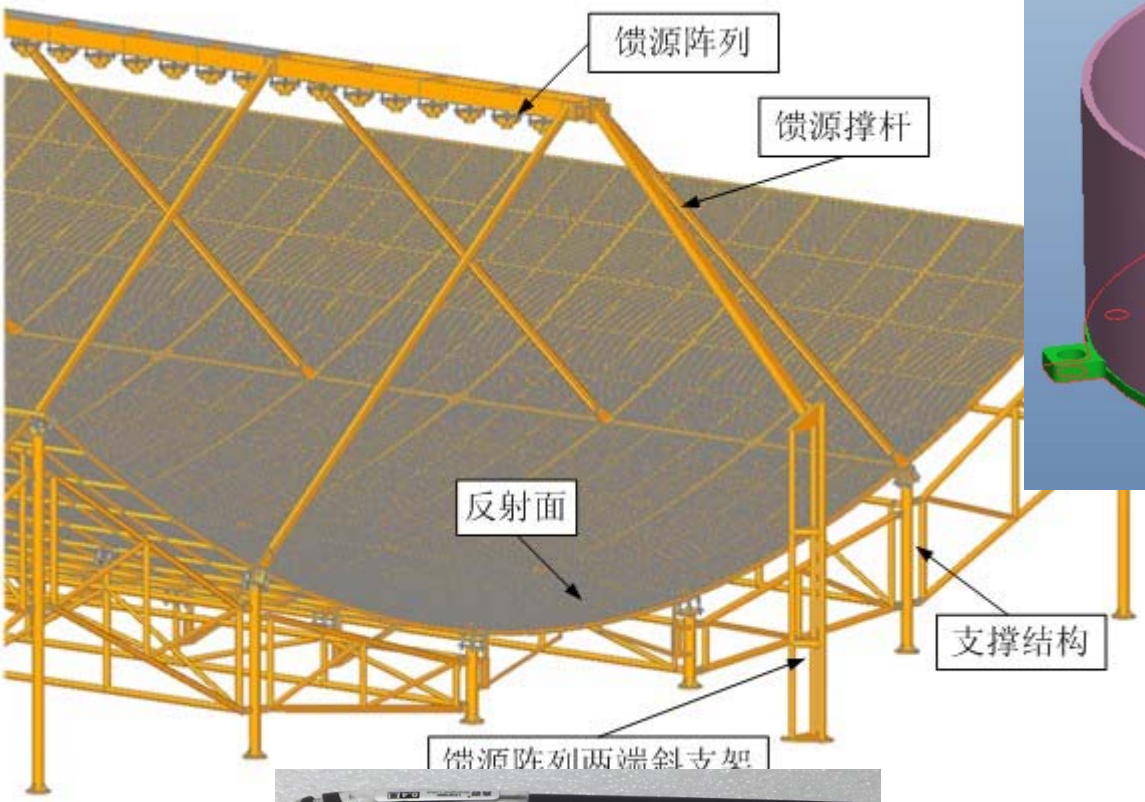
Plan II: cable(1km 8k),shielding chamber(40k),
power line(+100KW, 6.5km ??) > 60K & more RFI
C: maintain

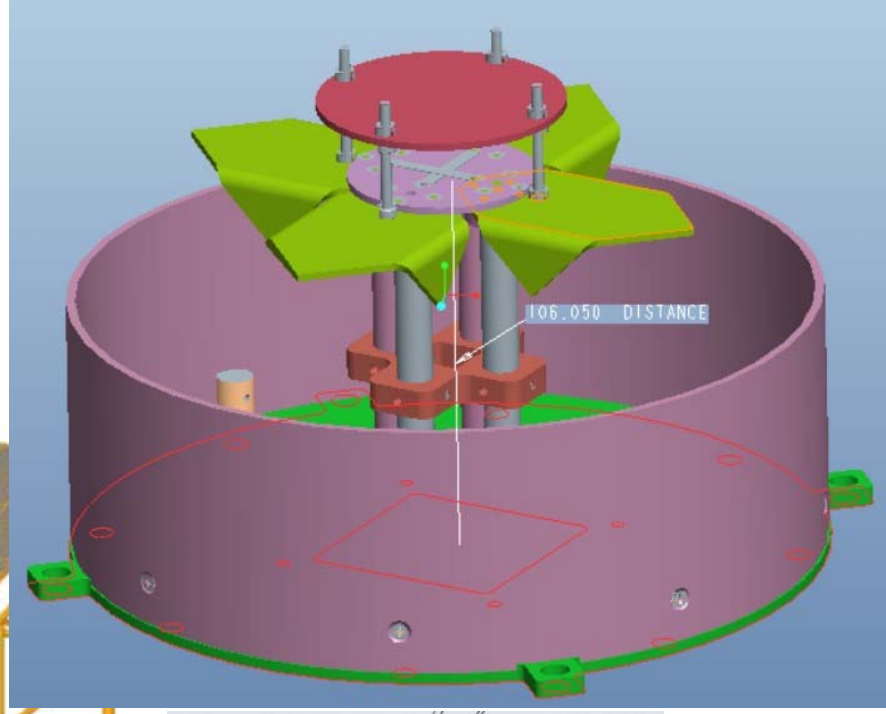
Open Issues for site

(2) How to make reference line more accurate? total station, north star, level indicator

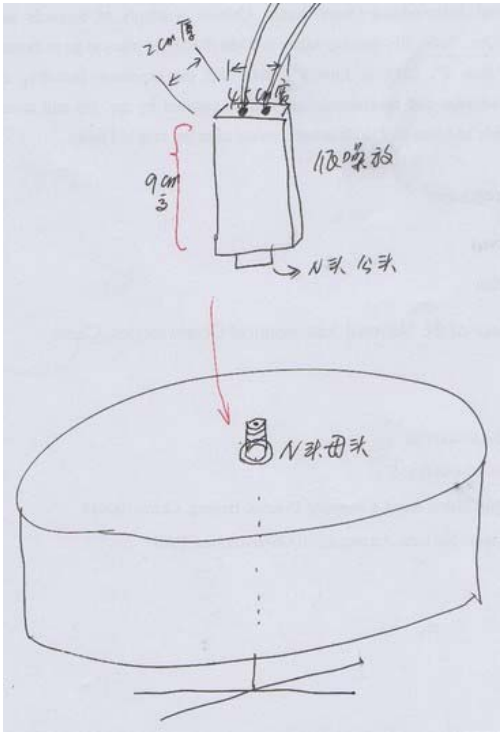
Sketch of electronic system



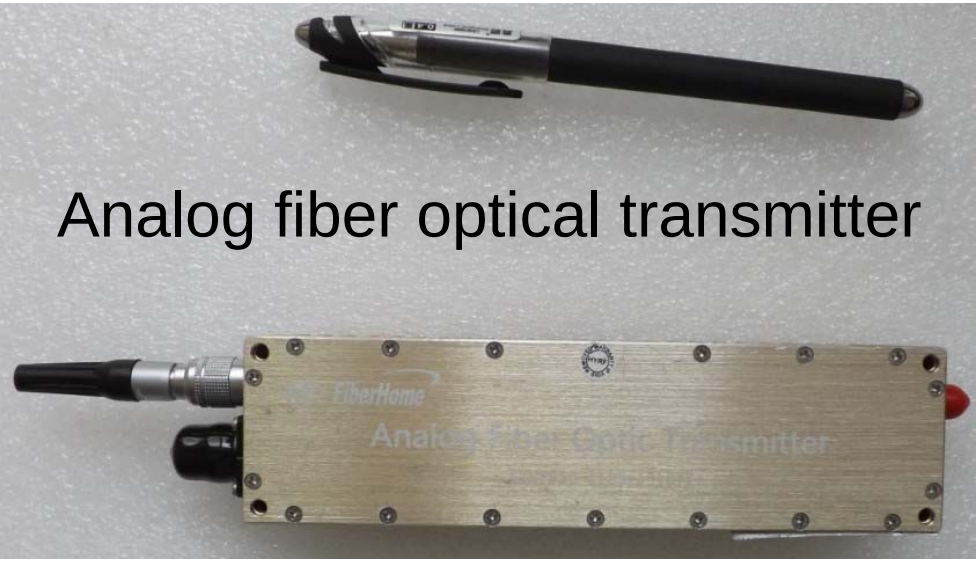

馈源阵列
馈源撑杆
反射面
支撑结构
馈源阵列两端斜支架


106.050 DISTANCE


LNA-800M-2
201310 No. 007
射频In
检测Out
检测In
射频Out


2cm厚
9cm高
吸噪板
N头 公头
N头母头

Frequency:0.4-1.5Ghz
NF=0.6 Tn=43K @750Mhz
Gain>53dB
Coaxial cable power supply

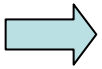


Frequency:0.4-1.5Ghz
DFB Lazer, no thermostat system
Gain>18dB
Pn=-140dBm
DC28V power
Power of light > 2.0dBm

Gain distribution in the front end

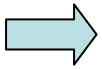
Attenna

Ta=50K
Pn=-182dBm/Hz



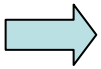
LNA

Gain=53dB



Coaxial cable

Atten=5dB



Optical transmitter

Gain=18dB

Before lazer: P=-116dBm

Pn_lazer=-140dBm/hz


FiberHome
Analog Fiber Optic Receiver
SZHY950-1100-1310RX


XS1
XS2
XS3
XS4
XS5
XS6
XS7
XS8
XS9
XS10
XS11
XS12
XS13
XS14
XS15
XS16
XS17
XS18
XS19
XS20
XS21
XS22
XS23
XS24
XS25
XS26
AC-220V
3
07-140432
07-140436
07-140440
07-140433
07-140437
07-140441
07-140434
07-140438
07-140435
07-140439
1
07-140410
07-140414
07-140418
07-140411
07-140415
07-140419
07-140412
07-140416
07-140420
07-140413
07-140417


中国科学院自动化研究所

Open Issues for electronic facility

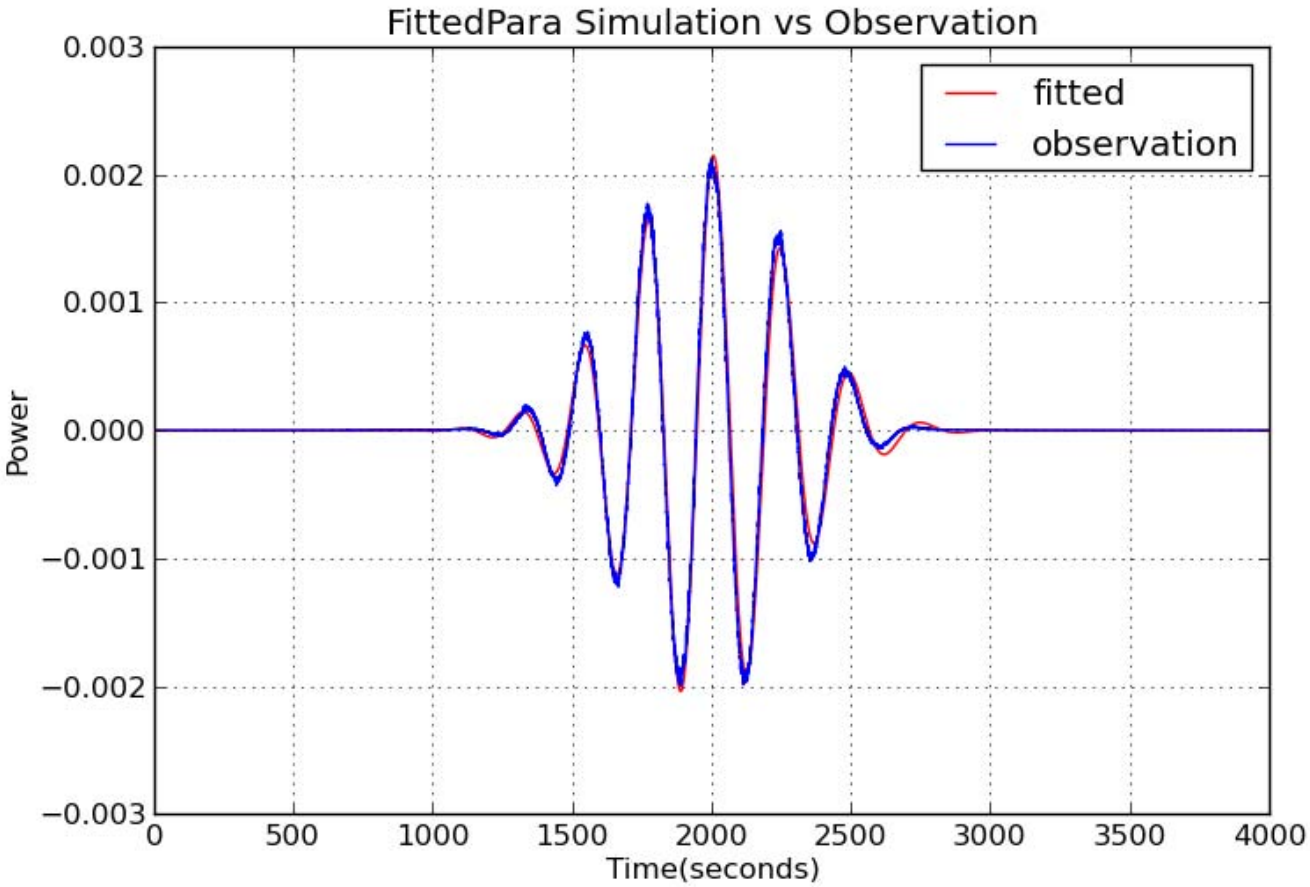
(1) How to distribute the gain in the system?

(2) Any function need be added?

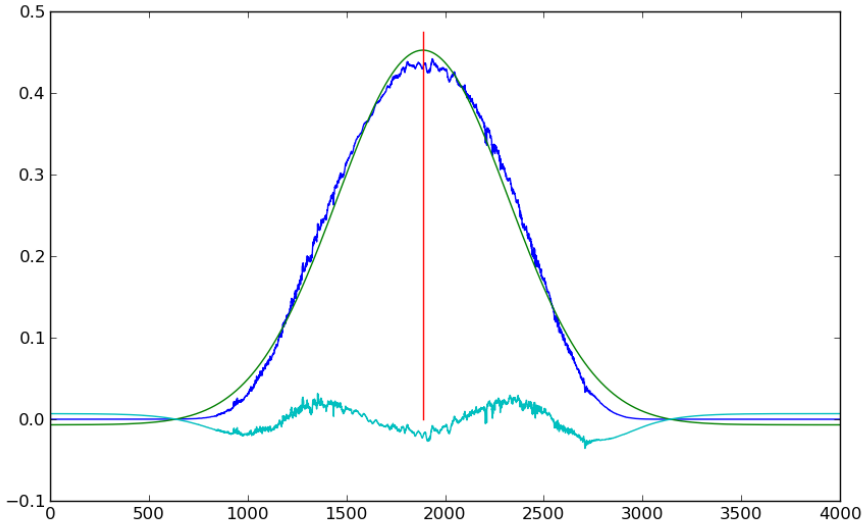
Testing experiment

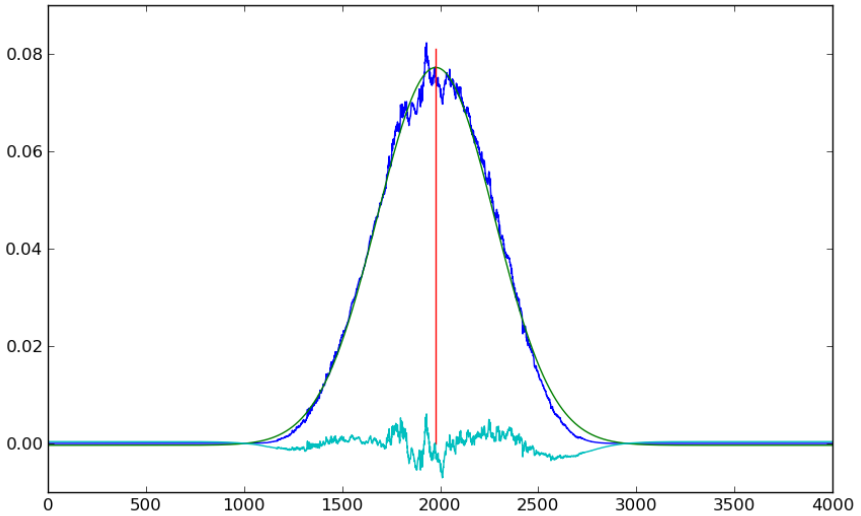
- 32-channel system
- 3 dishes(5m) in Inner-Mongolia
- Some tests before
- 3 Months

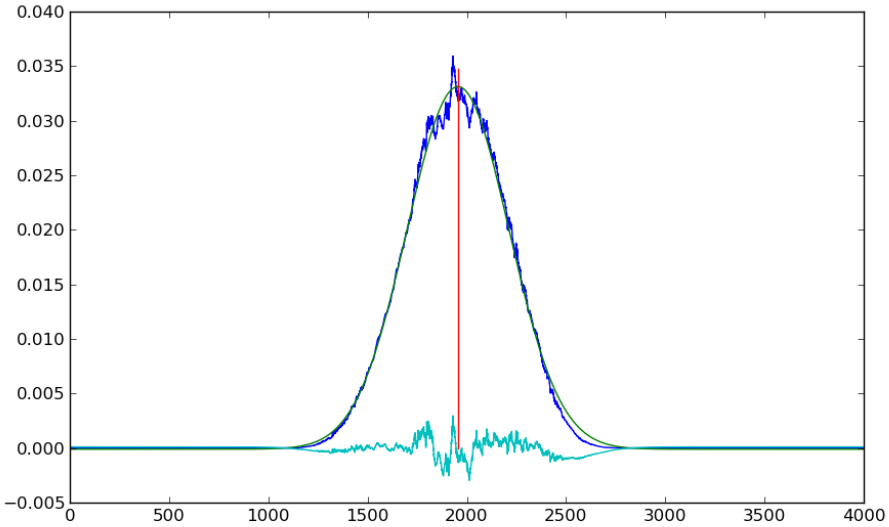
Total Power vs Time



Beam pattern



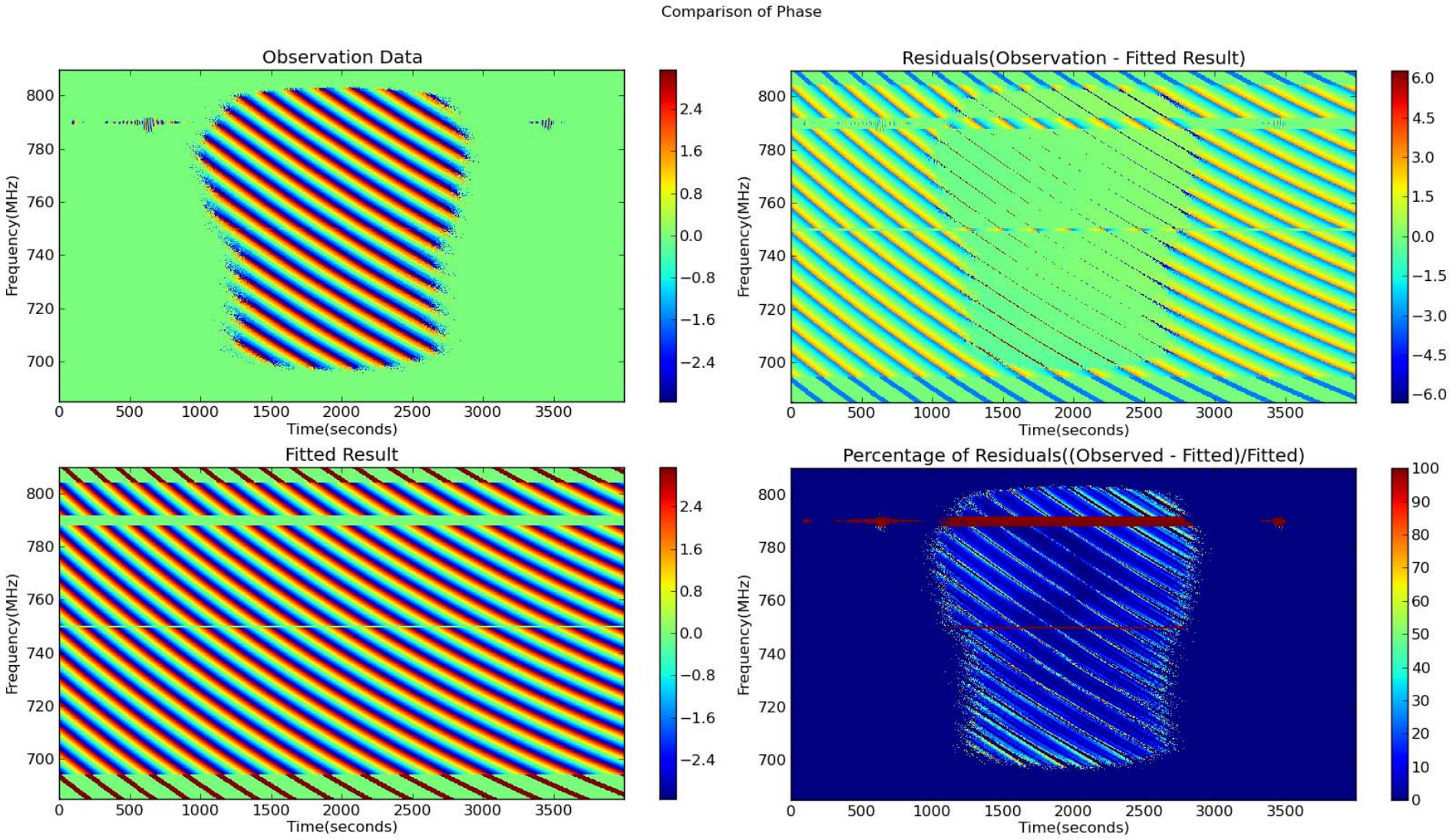


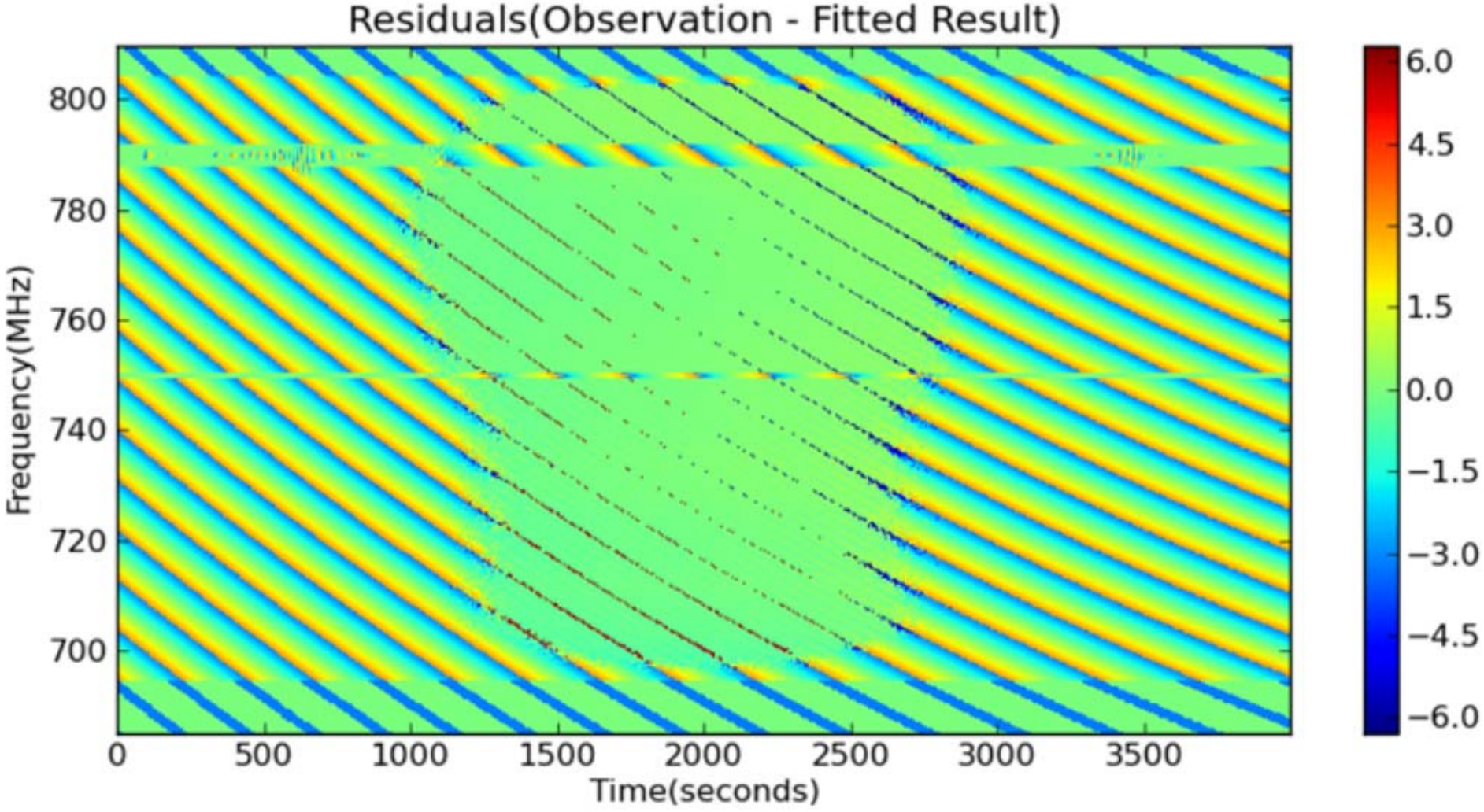


Ch11 | Ch55
Ch15 | note

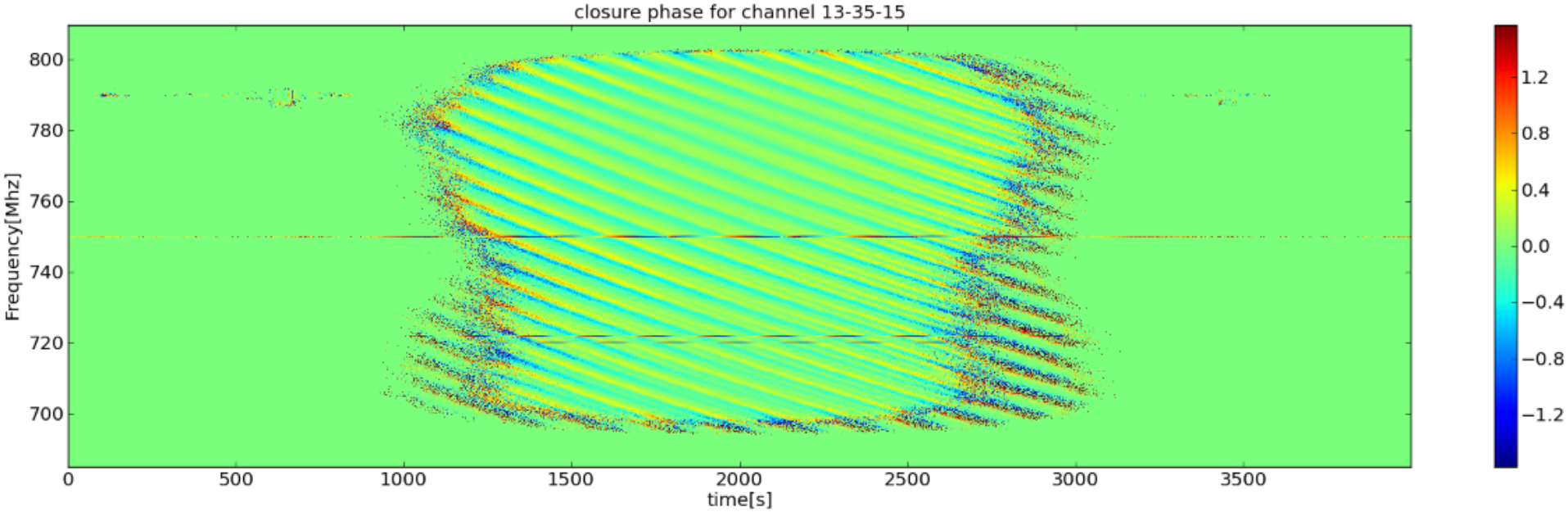
Blue: Observation;
Green: Gaussian-fitted;
Red: Center;
Cyan: residuals.

Phase vs Time




Residuals(Observation - Fitted Result)
Frequency(MHz)
800
780
760
740
720
700
0
500
1000
1500
2000
2500
3000
3500
Time(seconds)
6.0
4.5
3.0
1.5
0.0
−1.5
−3.0
−4.5
−6.0

Closure phase on 1 3 5 channels

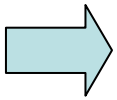


Ta measurement

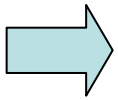
Signal generator

50Ohm terminator

Feed

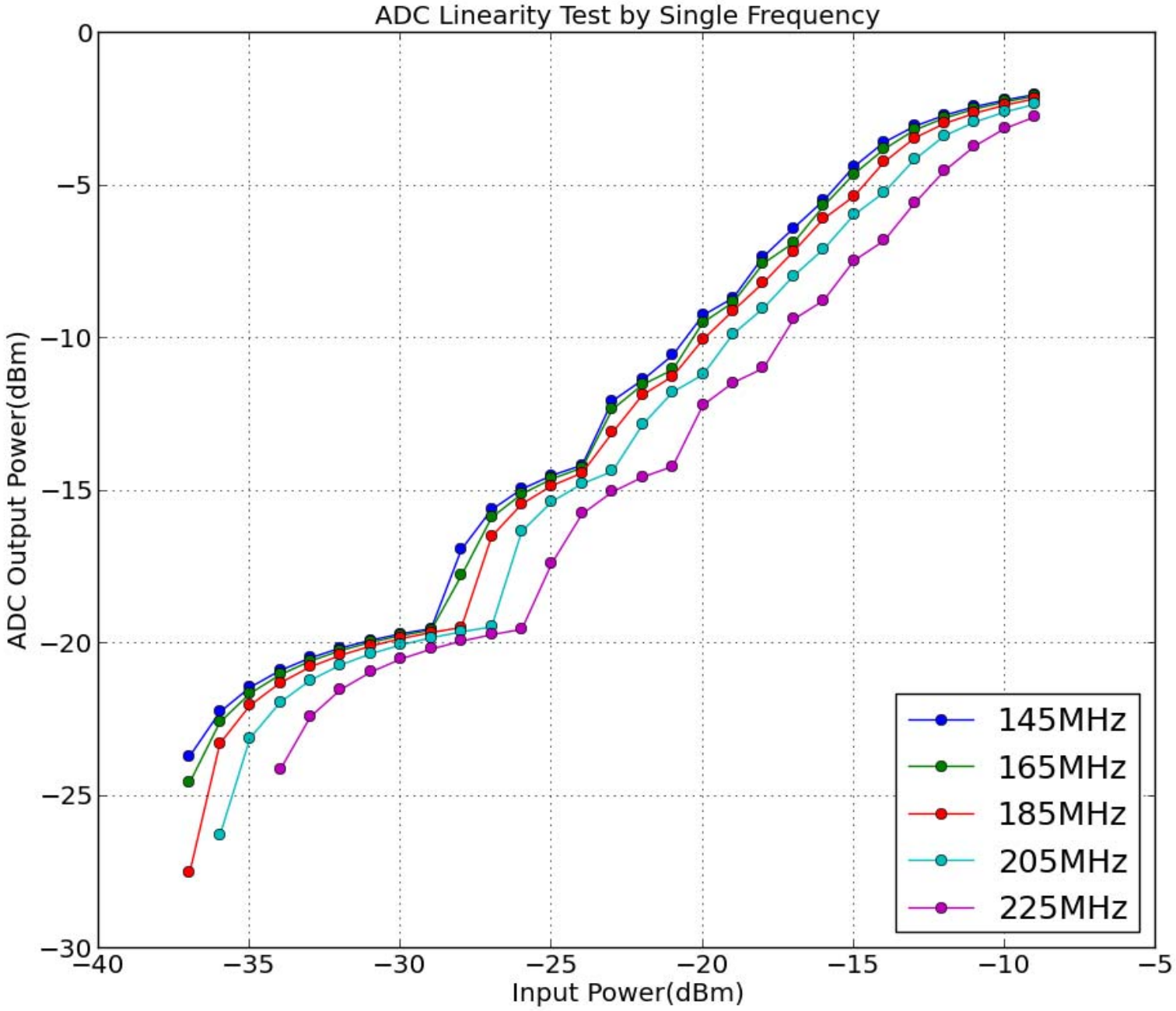


LNA+receiver



Spectrometer

Non-linearity in Correlator



Open Issues for testing experiment

(1) More observation on noise/sky source to understand the system

(2) Gain Stability

(3) ???